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General Editor : P. ABBOTT, B.A.

EXAMPLES  
IN  
ENGINEERING DRAWING

VOLUME 2

## **THE TECHNICAL COLLEGE SERIES**

**General Editor: P. ABBOTT, B.A.**

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THE TECHNICAL COLLEGE SERIES

# EXAMPLES IN ENGINEERING DRAWING

VOLUME 2  
(Second Year Course)

By

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## GENERAL EDITOR'S FOREWORD

Technical education stands on the verge of a great advance. Throughout the country there is widespread recognition of the necessity for a great expansion of the facilities which are available for systematic training for science and industry. There is also a general acceptance of the well-founded conclusions of experts that the economic prosperity of this country will, more than ever before, be dependent upon the efficiency and adaptability of our system of scientific and technical training.

It is the hope and ambition of those who have planned this series of technical books that it will meet the demands for new books which will follow these developments. New measures require new books and it is hoped that the series will not only assist in meeting these requirements but will incorporate those new methods and processes which have been introduced during the war years.

P. ABBOTT.

## AUTHOR'S PREFACE

The examples in Volume 2 are a continuation of those which appeared in Volume 1. The student is now expected to go a step further in producing the finished working drawing, by giving all dimensions in their correct position on the drawing, to have a knowledge of tolerances on dimensions, to be able to make a schedule of parts when required, and also to indicate where the parts shall be machined.

Several examples of structural details are given, to help students in the structural industry.

Sufficient information is included to assist students to attempt the exercises, which include curves of intersection, the proportion of gear teeth, etc.



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## DIMENSIONS

At this stage a student should be able to dimension fully a working drawing.

The main function of a drawing is to show the sizes to which the detail is to be made, so that there is no possibility of error. To do this, a few points must be remembered:—

1. All dimensions must stand out clearly on the drawing, if possible on the outside of the detail.

2. All figures should be at least  $\frac{1}{4}$ " high, and the dividing line should be horizontal.

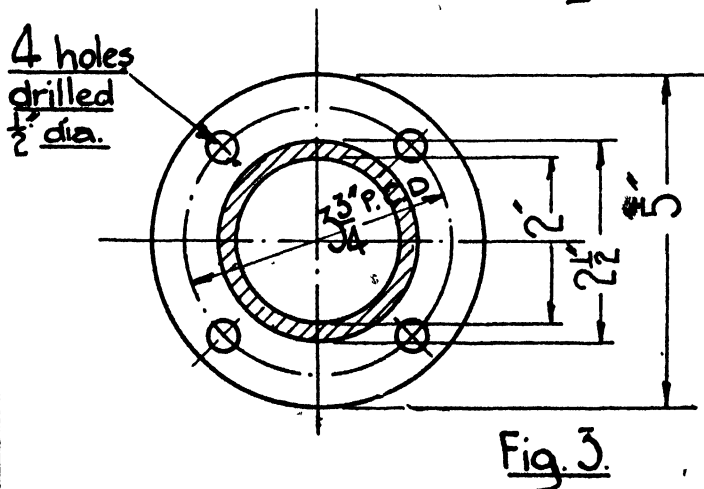
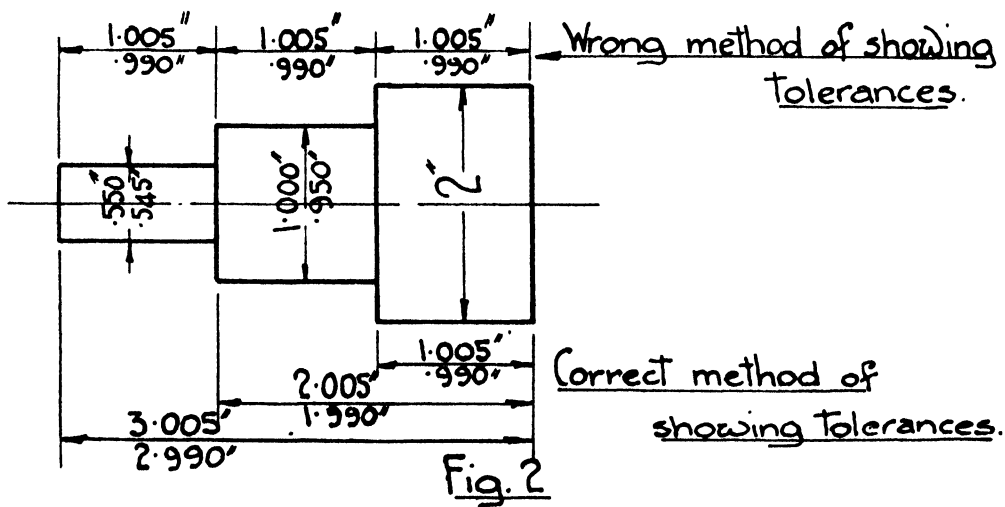
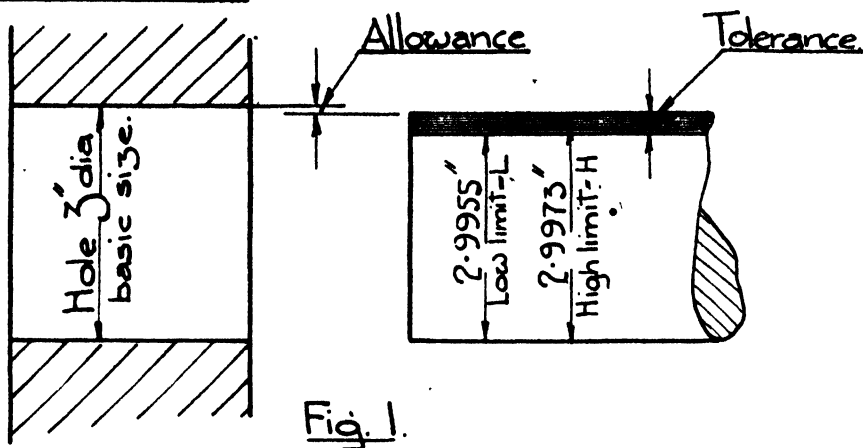
3. The figures should be placed in the middle of the dimension line, so that they may be read from the front and from the right-hand side of the drawing.

4. All lengths should be given from a datum line, especially in the case of shafts, as shown in Fig. 2, page 8. The reason for this is that, where tolerances are given, the shaft may be too long or too short, depending on whether the lower or higher tolerance has been adhered to.

5. When several circles occur, the best method is to take the dimensions outside the circles, as shown on Fig. 3, page 8. Diagonal dimensions must not be given, except in the case of a single dimension—e.g., pitch circle diameter of bolt holes.

6. Always dimension to the centre of holes from either a base line or a main centre line.

# DIMENSIONS



## LIMITS AND FITS

All the information required on this subject may be obtained from the *British Standard Handbook*, No. 2, published by the British Standards Institution for the use of engineers. Students should study this for use in the drawing office, but a rough idea of tolerances is given for use in the examples on Fig. 1, page 10.

There are several different fits to suit different requirements, and in the case of Fig. 1, page 8, a running fit is given in which the hole is a basic size, whilst the diameter of the shaft may vary. The TOLERANCE is the difference between the high and low limits. The ALLOWANCE is the difference shown between the high limit of the shaft and the basic size of the hole, to allow for a running fit in this particular size of shaft.

Machining allowance must not be confused with the allowance on dimensions; it is the allowance on certain portions of castings and forgings where they are required to be machined, as shown in Fig. 1, page 10.

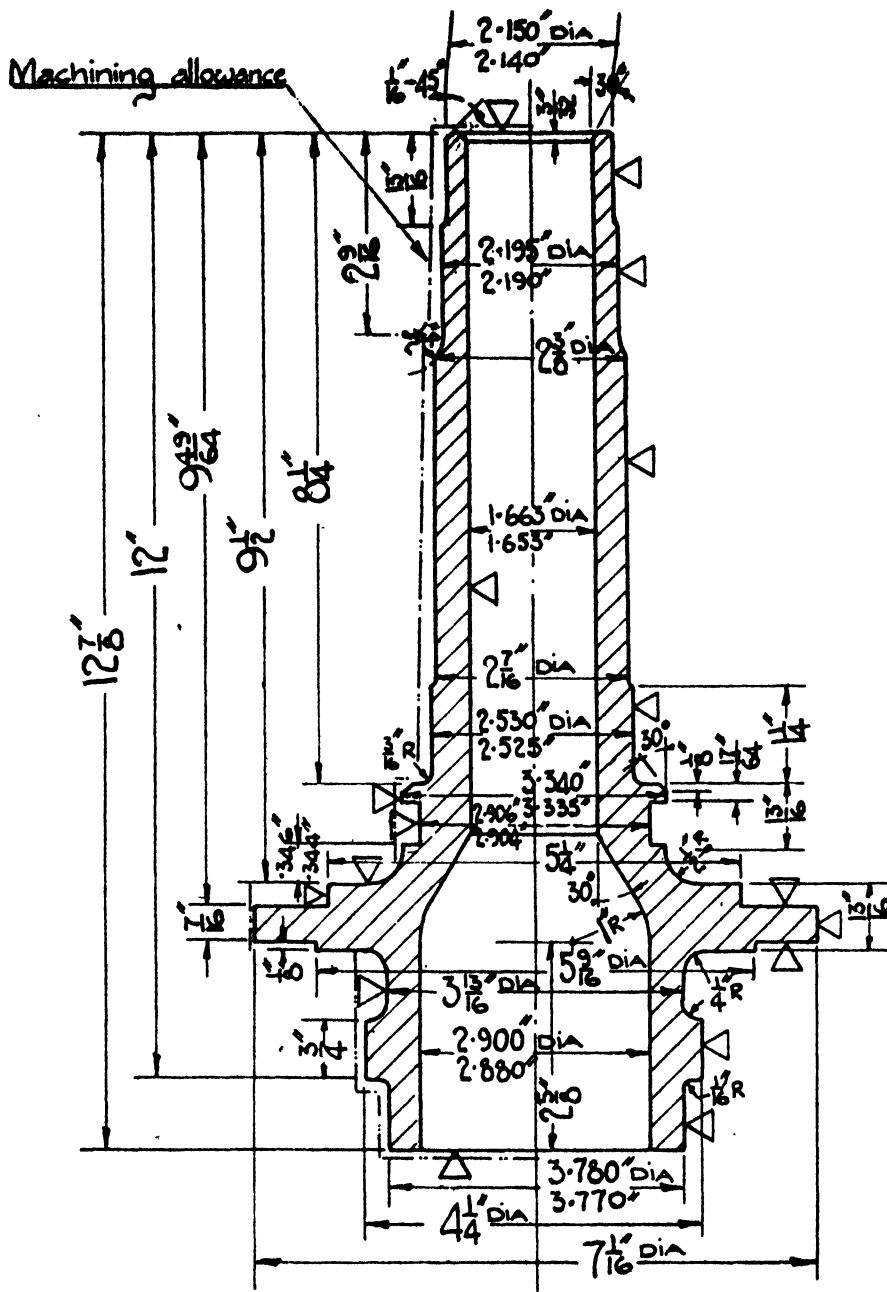


Fig. 1

## MACHINING

The tendency in modern drawing-office practice is to give as much information as possible on a working drawing with regard to the degree of finish on machined parts.

There are several methods of showing the finish required, but students are advised to adopt the method which has been standardized by the British Standards Institution, as shown on page 12, method No. 4.

In this method an equilateral triangle having sides about  $\frac{1}{4}$ " long is used, with one point of the triangle touching the surface to be machined. A letter is used to indicate the particular process required.

## SCALES

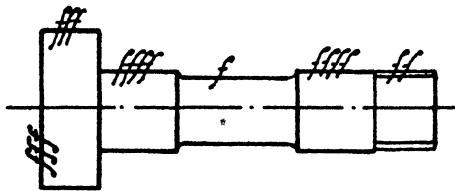
The method recommended for showing the scale on a drawing is as follows:—

Scale full size to be stated	1/1
„ half „ „	1/2
„ 3" = 1 foot „	1/4

and all other scales to be shown as a fraction.

# MACHINING

## Method No. 1.



## Method 1. Method 2.

$f$  or  $\nabla$  = rough machining.

$ff$  or  $W$  = smooth finish.

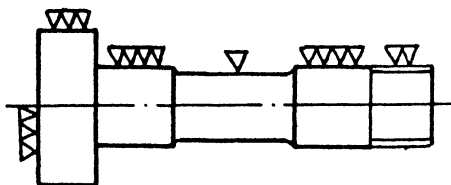
$fff$  or  $WW$  = smooth and ground finish, by polishing with emery or other abrasive.

$ffff$  or  $WWW$  = smooth and ground finish highly honed with very fine abrasive

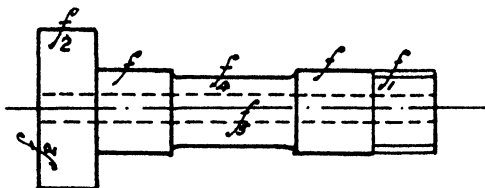
$G$  = Ground. This varies

according to the abrasive wheel and coolant.

## Method No. 2.



## Method No. 3. The fractions indicate the amount of feed on the machine.



$f$  = finish

$f_1 = \frac{1}{32}$  "

$f_2 = \frac{1}{16}$  "

$f_3 = \frac{3}{32}$  "

$f_4 = \frac{1}{8}$  "

$f_5 = \frac{5}{32}$  "

## Method No. 4.

$\nabla$  Machine all over.

$\nabla$  Bore

$\nabla$  Turn

$\nabla$  Plane

$\nabla$  Drill

$\nabla$  Grind

System recommended by the British Standards Institution.

Draw an equilateral triangle with sides about  $\frac{1}{4}$  long, with one corner of the triangle touching

the machined surface, and insert a letter to

indicate the type of machining. For surface finish a ground surface is indicated by a number  $\nabla$ .

## SCHEDULES AND LABELS

It is the practice on all drawings to have a label in the bottom right-hand corner. These labels may vary considerably in different workshops, according to the information they are required to give, but the student is advised to adopt a label similar to that given on Example 1, page 15. The size of the label will depend on the space available, but need not be more than  $5'' \times 2\frac{1}{2}''$ .

There are several systems of preparing the drawing for the workshop. Some firms prefer to make a separate drawing of each detail, as in Example 1; others make drawings with several details combined, as in Example 2, or with several details drawn separate on one sheet, as in Example 3, together with an assembly drawing.

In Examples 2 and 3 a schedule would be required.

The schedule is of great value in every department of the works, including the cost office and other offices, because each part is given a reference letter, and the workmen may book their time employed on the item by reference to the letter, drawing No. and the Order No.

Students are advised to practise making out a schedule on all drawings having several parts, and so acquire facility in stating the materials required for each part.



The reference letter should be placed in a circle  $\frac{1}{2}''$  diameter, with an arrow pointing to the particular item.

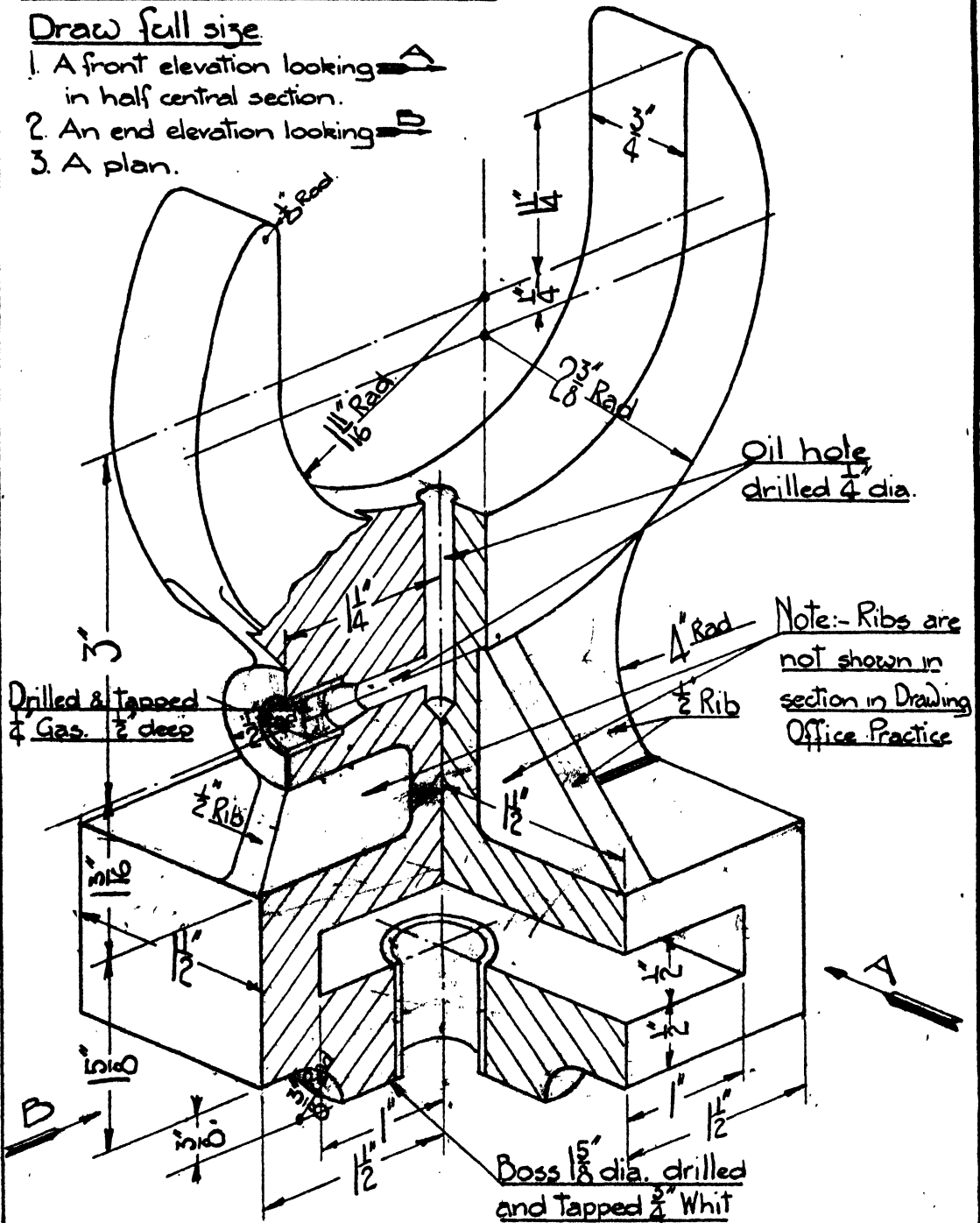


CLUTCH FORK Cast iron.

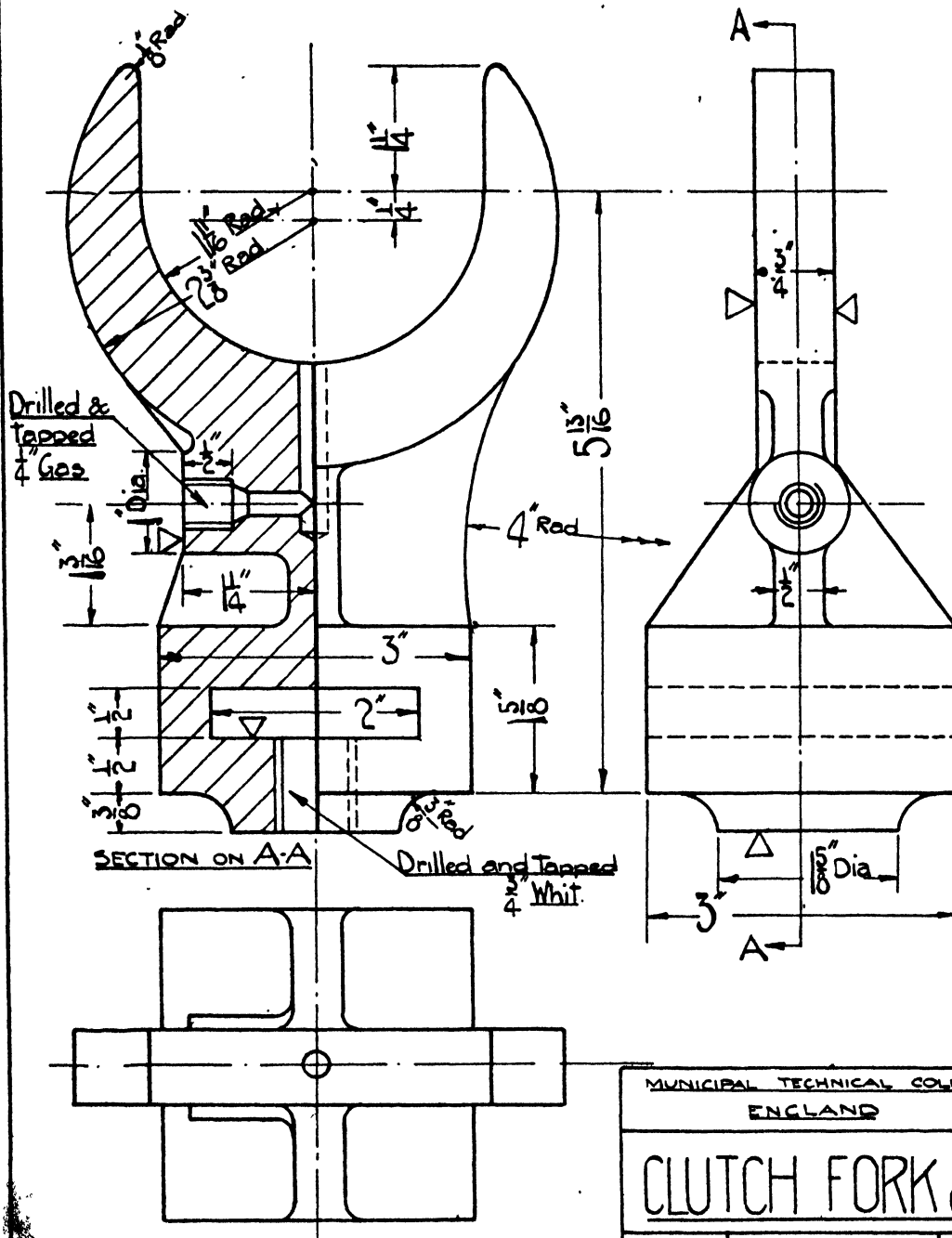
EXAMPLE NO.1.

Draw full size.

1. A front elevation looking 
2. An end elevation looking 
3. A plan.

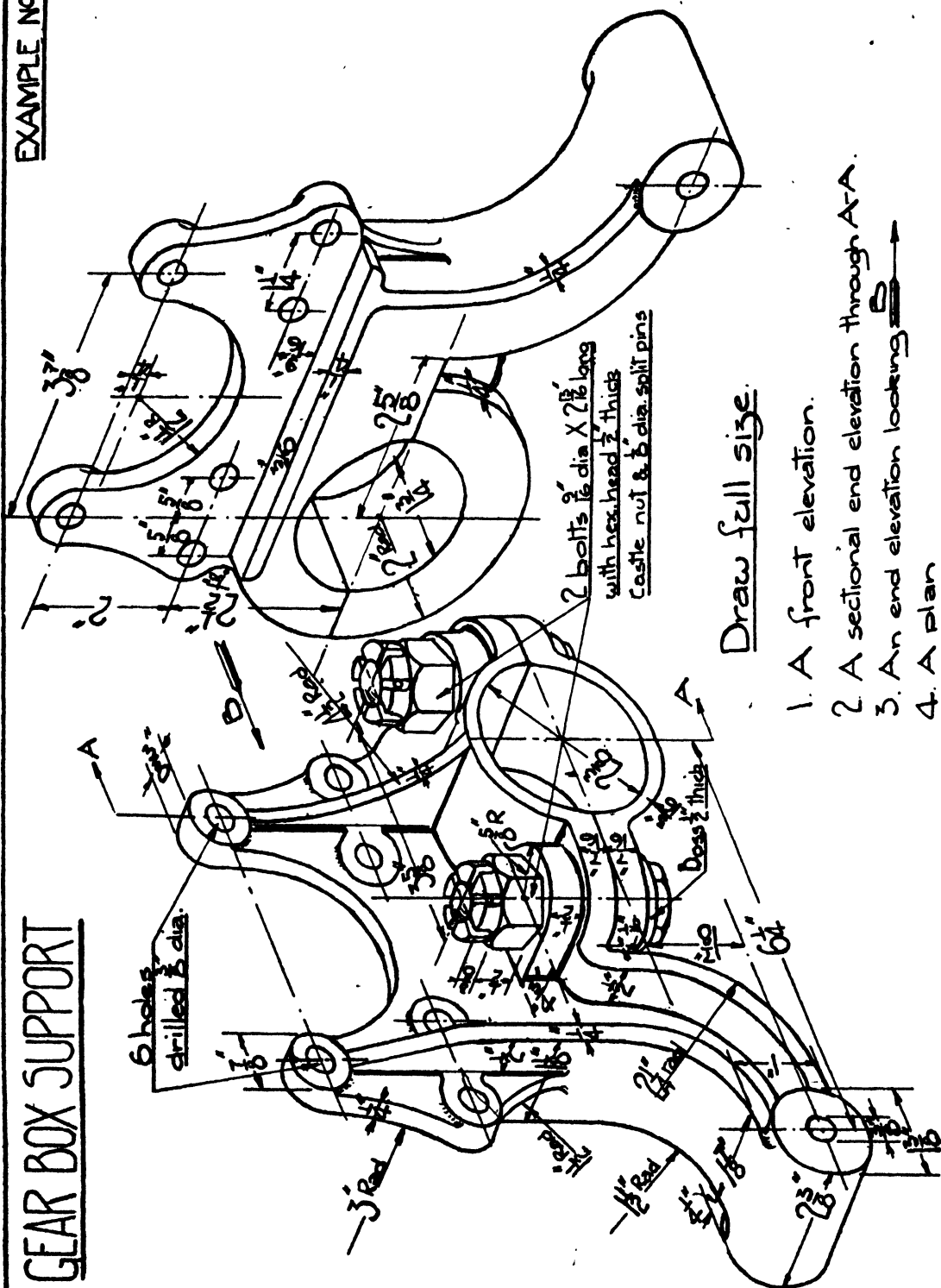


## SOLUTION TO EXAMPLE NO.1.





## GEAR BOX SUPPORT

## EXAMPLE NO 2.

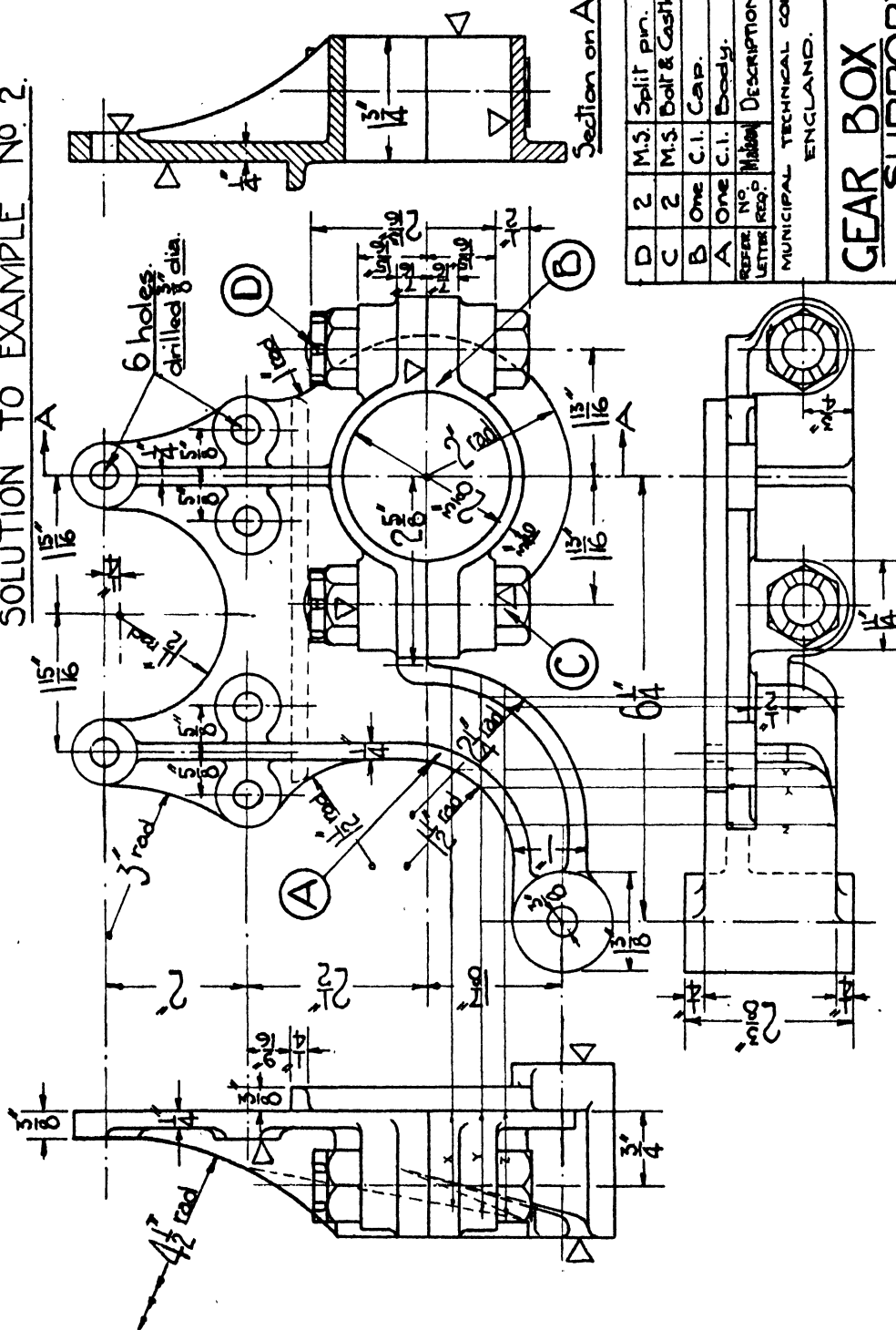


2 bolts  $\frac{9}{16}$  dia X  $2\frac{1}{2}$  long  
with hex. head  $\frac{1}{2}$  thick  
Castle nut &  $\frac{1}{2}$  dia. split pin

Draw full size.

1. A front elevation.
2. A sectional end elevation through A-A.
3. An end elevation looking  
4. A plan

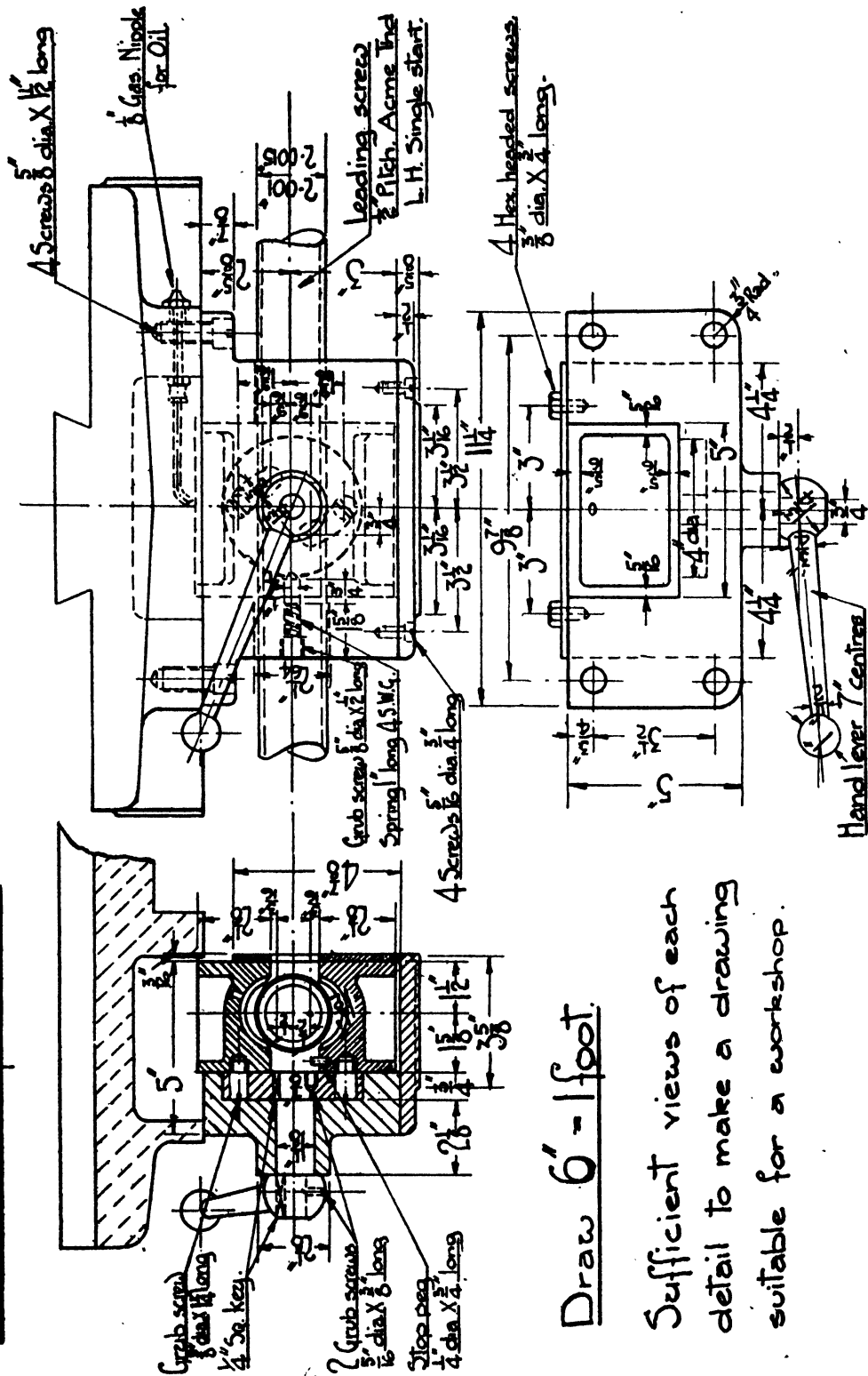
SOLUTION TO EXAMPLE NO. 2.



D	2	M.S	Split pin.
C	2	M.S	Bolt & Castle nut.
B	One	C.I.	Cap.
A	One	C.I.	Body.
REFER LETTER	NO.	Material	Description.
MUNICIPAL TECHNICAL COLLEGE ENGLAND.			
<u>GEAR BOX</u>			
<u>SUPPORT.</u>			
SCALE.	NAME.		DATE.
1/1			

# NUT BOX for Lathe.

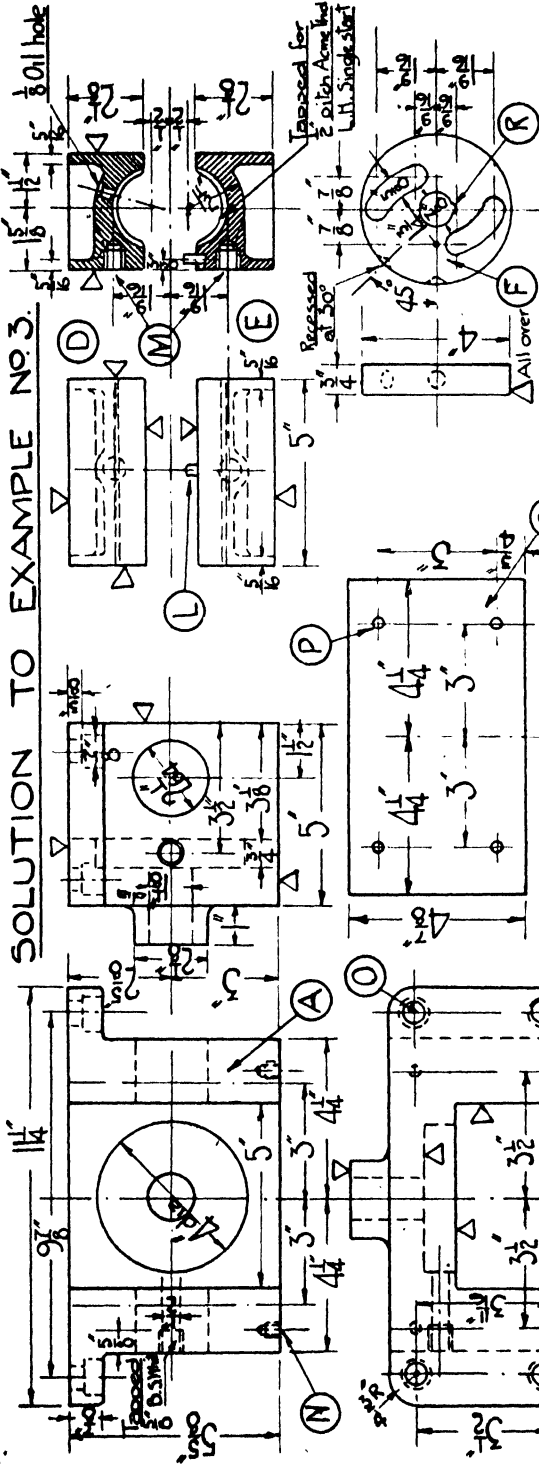
EXAMPLE NO 3.



Draw 6'-1 foot.

Sufficient views of each detail to make a drawing suitable for a workshop.

# SOLUTION TO EXAMPLE NO.3.

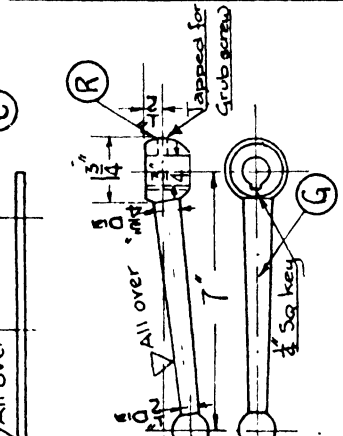


L	One	M.S	Stop peg $5/8 \times 3/4 \times 1/2$ L
K	One	M.S	Stop peg
J	One	Steel	Spiral spring
H	One	M.S	Shaft
G	One	M.S	Hand lever
F	One	M.S	Cam
E	One		Bottom half nut
D	One		Top half nut
C	One	M.S	Side cover
B	One	C.I	Bottom cover
A	One	C.I	Nut box
REFER LETTER REQ.	No	Mat	DESCRIPTION

MUNICIPAL TECHNICAL COLLEGE  
ENGLAND.

## NUT BOX

SCALE	NAME	DATE
1/2		



R	2	M.S	Grub screws $5/8 \times 1 \times 1/2$ L
Q	2	M.S	Keys $3/8 \times 1/2 \times 1/2$ Square
P	4	M.S	Hex Hd screws $5/8 \times 1 \times 1/2$ L
O	4	M.S	Hex Hd screws $5/8 \times 1 \times 1/2$ L
N	4	M.S	Hex Hd screws $5/8 \times 1 \times 1/2$ L
M	2	M.S	Grub screws $5/8 \times 1 \times 1/2$ L

## CURVES OF INTERSECTION

The line of interpenetration due to the intersection of two solids is determined by geometrical construction.

The method of construction for simple pipe intersection is shown in Figs. 1, 2, 3, and 4.

Fig. 1 shows a branch pipe meeting the main pipe at right angles. The pipes in this case are of equal diameters. Draw the elevation and the plan as shown, and construct a semi-circle on the branch pipe in the plan and the elevation. Divide the semi-circle into, say, six equal parts with either compasses or 60-degree set-square, and mark A, B, C, and D on each view. Project horizontal lines from each letter on the plan to  $A^1$ ,  $B^1$ ,  $C^1$ , and  $D^1$ , and project from the plan to the elevation to meet the horizontal projectors at  $A^2$ ,  $B^2$ ,  $C^2$ , and  $D^2$ . The line of intersection is obtained by drawing through these points, and in this case it would be a straight line.

Figs. 2, 3 and 4 may be constructed in a similar manner.

NOTE.—When pipes having the same diameter intersect, whether at right angles or any other angle, the resulting line of intersection will be a straight line, as shown in Fig. 3.

The usual practice in a drawing office, when showing intersection lines, is to fix the point  $D^2$  (see Fig. 2) by projecting from a point  $D^1$  on the plan, and then, using compasses set to a suitable radius "M", to join the points  $A^2$  and  $D^2$ . Of course, this is not quite accurate, but is all that is required on most workshop drawings.

Fig. 5 shows the curve that may be developed on a connecting rod by the following method:—

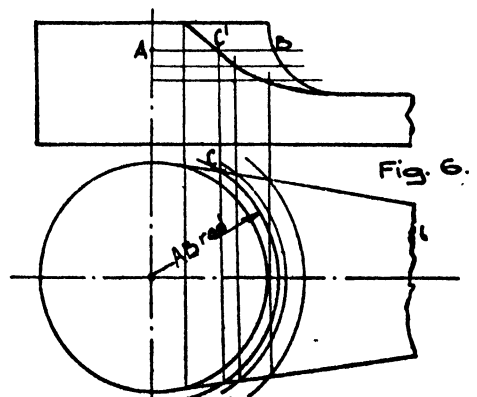
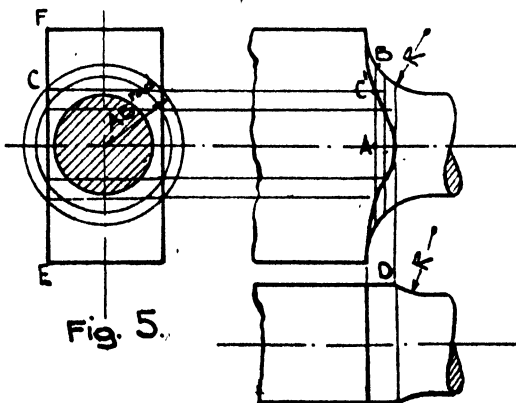
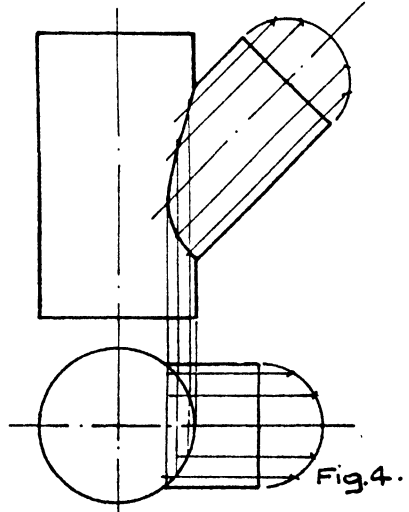
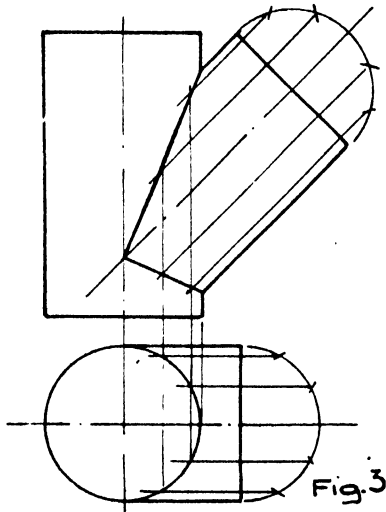
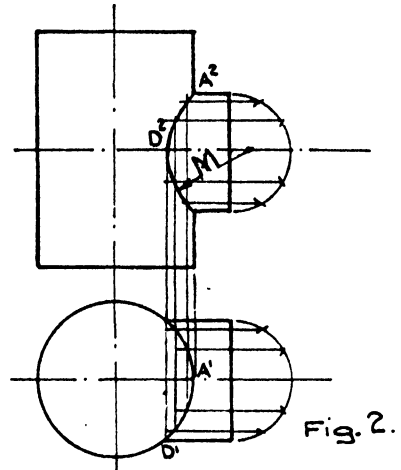
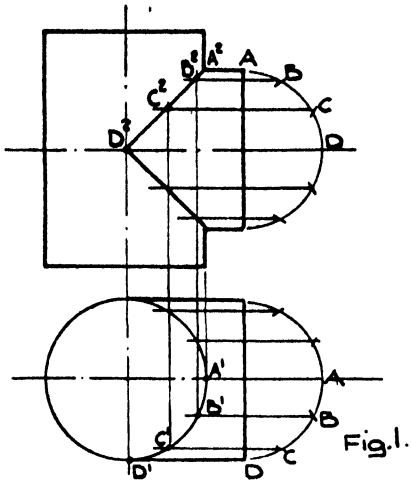
The diagram on page 21, Fig. 5, shows three views of a part of a connecting-rod end. Divide the curved portion, where the round rod joins the rectangular part, into several slices from about  $\frac{1}{8}$ " to  $\frac{1}{4}$ " apart. With a radius of A-B draw an arc on the end elevation, to cut EF at C. Project the point C back on to the line A-B to  $C^1$ , and this will give one point of the required curve. Similar points may be obtained by taking several radii.

Note that the plan shows where the curve or fillet finishes on the plan at D.

Fig. 6 shows the curve that occurs on cranks, levers, and some shaft brackets.

The construction is the same as in Fig. 5, but it is usual in drawing-office practice to use the same radius for both curves.

# CURVES OF INTERSECTION.





## STRUCTURES

Steel structures are rolled to standard shapes, and are used to construct buildings, bridges, boilers, tanks, conveyors, gasholders, frames, cranes, etc.

Examples of various common sections are shown on page 23.

The standard sizes may be obtained from the handbooks published by the leading manufacturers.

Fig. 1 shows a rolled steel joist (R.S.J.), sometimes called a girder of "H" section.

Fig. 2 shows a channel.

When joists and channels are used in a horizontal position, and subject to flexure, they are referred to as beams, but when used in a vertical position, they may be referred to as columns, stanchions or struts.

Figs. 3 and 4 show an equal and an unequal angle respectively.

Fig. 5 shows a tee.

In addition to the above sections, flat bars, round bars, (black or bright), half-round bars, square bars, and hexagon bars may be obtained to standard sizes, in addition to sheet steel of various sizes.

Stiffeners may be made from angles and tees by shearing out pieces at 90 degrees, and then bending and welding, as shown in Fig. 6.

Rivets have been standardized by the British Standards Institution, and several of the simplest types are given, with proportions for use in the drawing examples.

# STRUCTURE DETAILS.

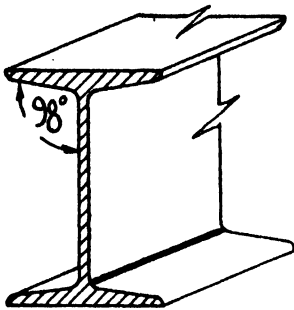


Fig. 1.

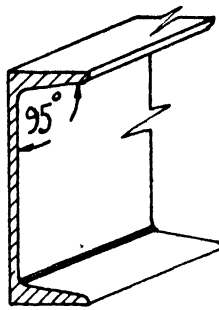


Fig. 2.

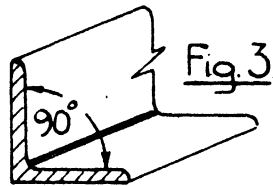


Fig. 3.

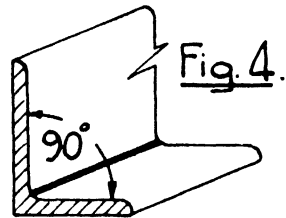


Fig. 4.

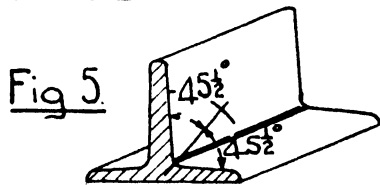


Fig. 5.

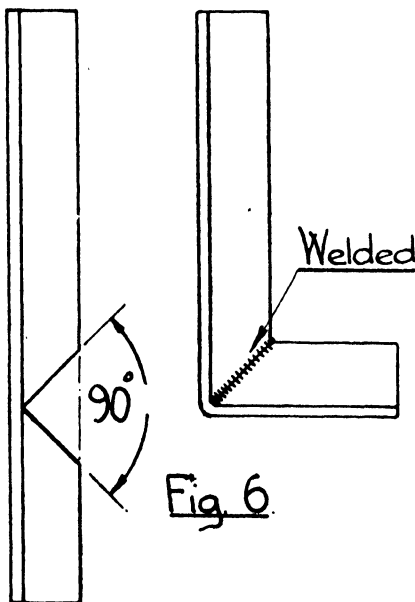
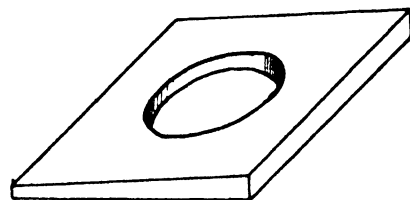
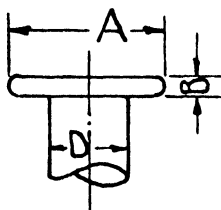


Fig. 6.



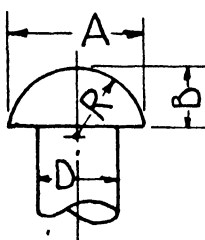
Square taper washer, made to suit angle of section



Flat

$$A = 2D.$$

$$B = .25D.$$

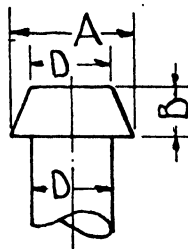


Snap

$$A = 1.75D.$$

$$B = .75D.$$

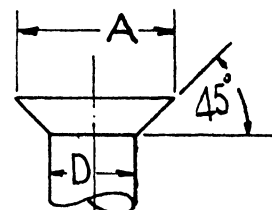
$$R = .885D.$$



Pan.

$$A = 1.6D.$$

$$B = .7D.$$



C's'k (countersunk)

$$A = 2D$$

$$B = .5D$$

## GEARS

There are three recognised methods of specifying the pitch of gear teeth:—

(a) Circular or arc pitch [ $P_a$ ], measured from one point on the tooth to a similar point on the next tooth on the pitch circle, as shown in Figs. 1 and 2.

(b) Diametral pitch [ $DP$ ], the ratio of the number of the teeth “ $N$ ” to the pitch circle diameter  $P.C.D.$ ;

or 
$$DP = \frac{N}{P.C.D.}; \text{ also } DP = \frac{\pi}{P_a}.$$

(c) Module [ $m$ ], the ratio of the pitch-circle diameter to the number of teeth;

or 
$$m = \frac{P.C.D.}{N}; \text{ also } m = \frac{1}{DP}, \text{ and } m = \frac{P_a}{\pi}.$$

The outside diameter  $OD$  of a gear wheel may be obtained by the formula

$$OD = \frac{N + 2}{DP}.$$

There are two geometrical curves that give correct velocity ratio for gear teeth: (a) Cycloidal, (b) Involute.

Fig. 1 shows the proportions for cycloidal teeth, and an approximate method of showing the shape of the teeth on a working drawing by using the radii  $X$  and  $Y$  from the centre of each tooth, but the true shape must be obtained by geometrical construction.

Fig. 2 shows the profile of involute teeth, with the approximate method of drawing the shape of the tooth with a radius “ $Z$ ”.

The profile of involute teeth is obtained by geometrical construction. The curve is developed on a base circle, as shown in Fig. 4. Draw the pitch circle diameter, and from a point  $O$  draw a line at an angle  $\theta$ .

This angle is called the pressure angle, and varies from  $14\frac{1}{2}$  degrees to 22 degrees. The British Standards angle is 20 degrees. Draw a line at right angles to the pressure angle, and the radius of the base circle is  $M$ .

Fig. 3 shows the names of the various parts of gear teeth.

When setting out a pair of bevel wheels, it is necessary to draw the two cones in contact, as shown in Fig. 5.

In some drawing-offices this is all that is given on a working drawing, together with the particulars of teeth, etc.

In Fig. 6 the teeth are shown drawn on the cones by setting off the sizes of the addendum and the dedendum  $A$  and  $B$  of the teeth from the formula given below.

Tooth proportions of standard teeth:—

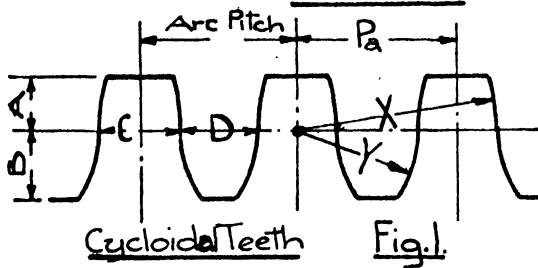
$$\text{Addendum} = \frac{1}{DP} = 0.3183 P_a. \quad \text{Dedendum} = \frac{1\frac{1}{4}}{DP} = 0.3979 P_a.$$

Therefore the clearance at the bottom of the teeth is

$$\frac{\frac{1}{4}}{DP} = 0.0796 P_a.$$

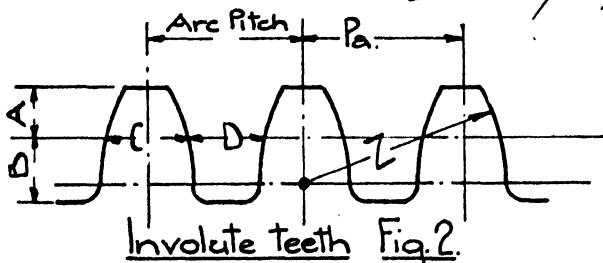
Fig. 7 shows the complete section of the bevel wheels as is required on Sheet No. 21 B.

# GEARS



Cycloidal Teeth

Fig. 1.



Involute teeth

Fig. 2.

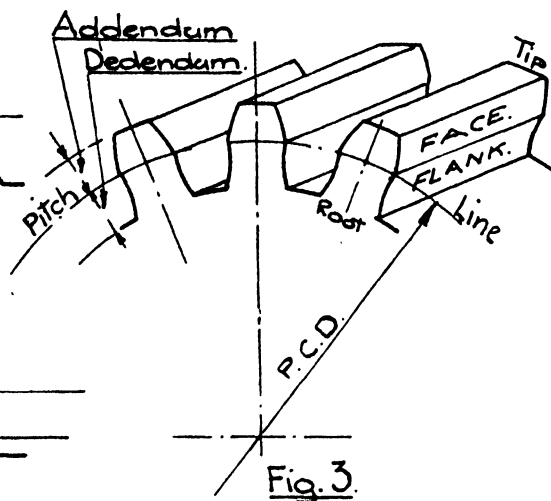


Fig. 3.

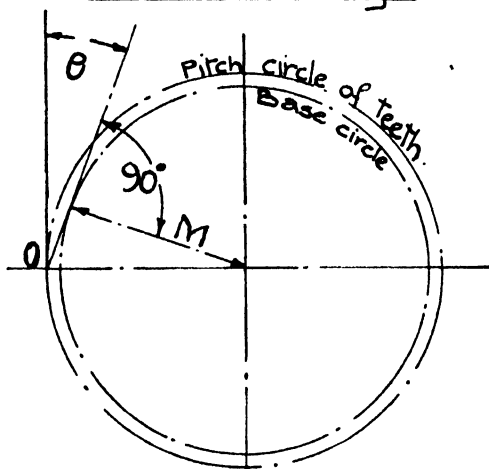


Fig. 4.

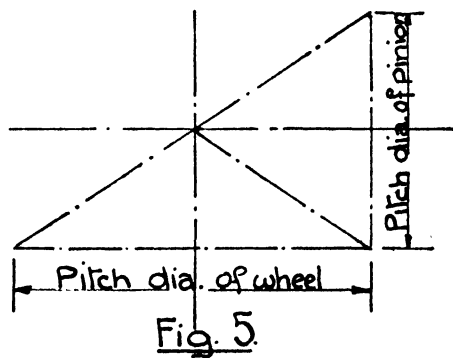


Fig. 5.

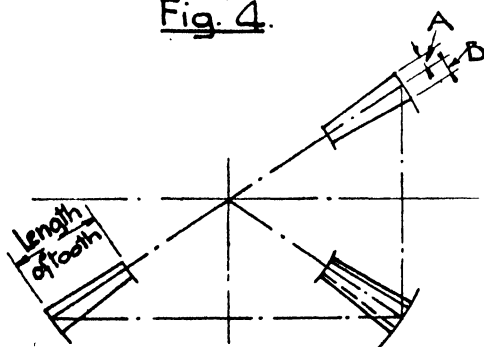


Fig. 6.

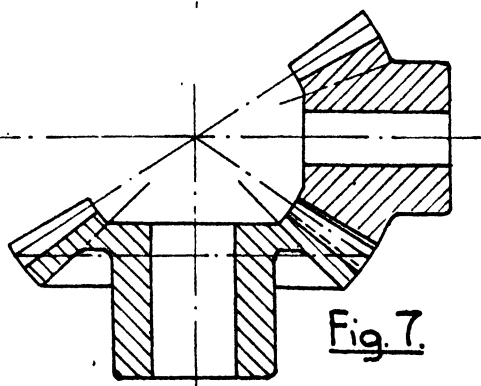


Fig. 7.

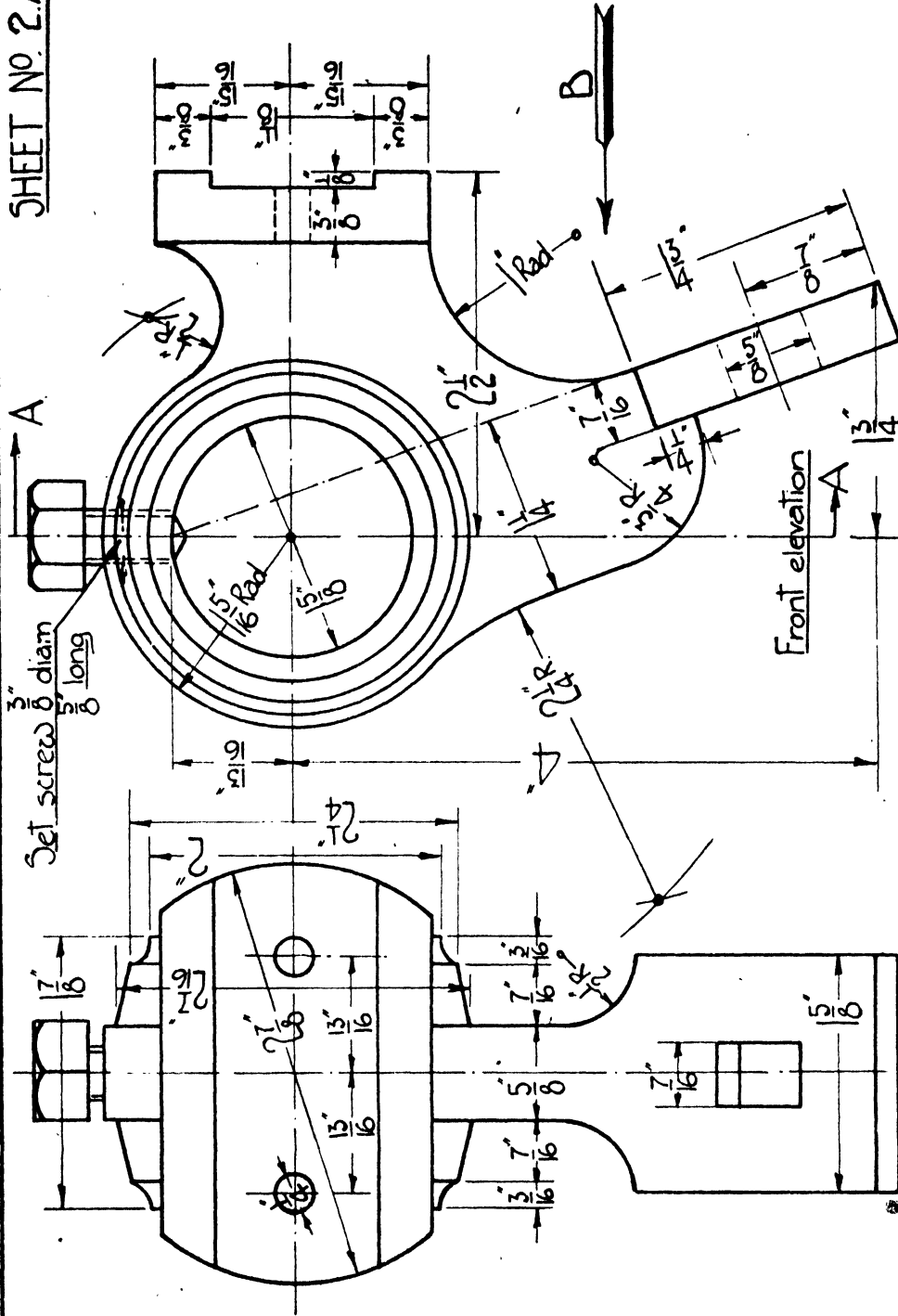
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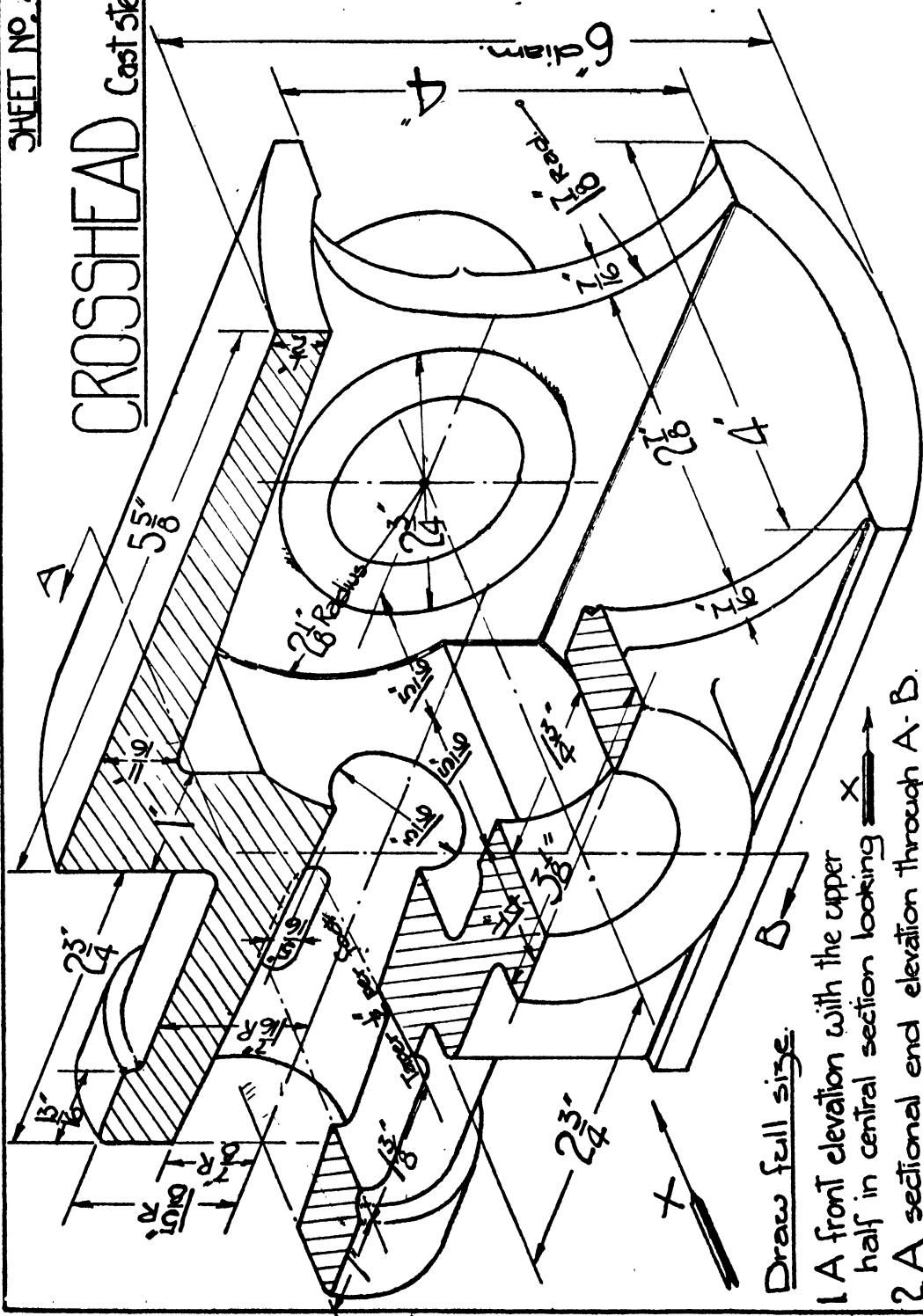
HINGE BRACKET cast iron





# CROSSHEAD

Cast steel.



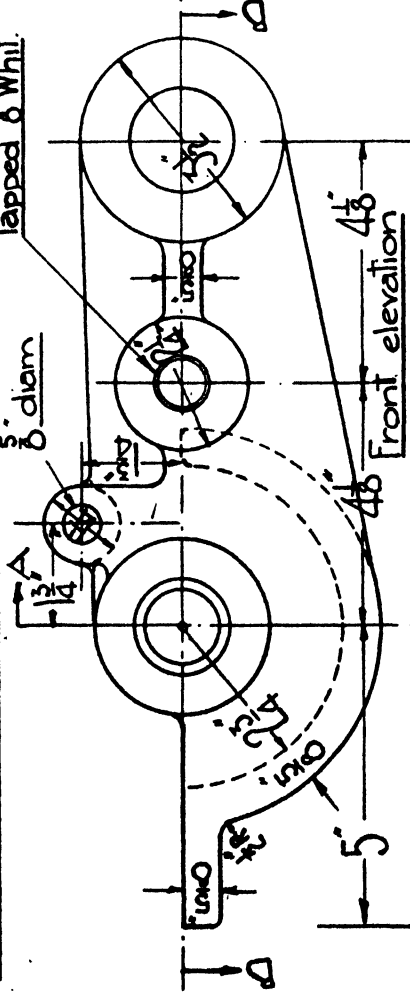
Draw full size.

- 1 A front elevation with the upper half in central section looking  $\times$
- 2 A sectional end elevation through A-B.
- 3 A plan in half central section

SWING BRACKET cast iron

Tapped 6 Whit.

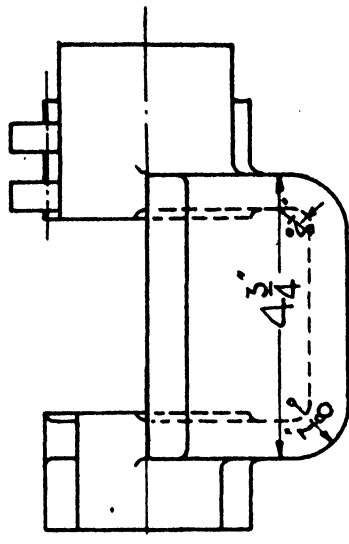
5" diam



Front elevation

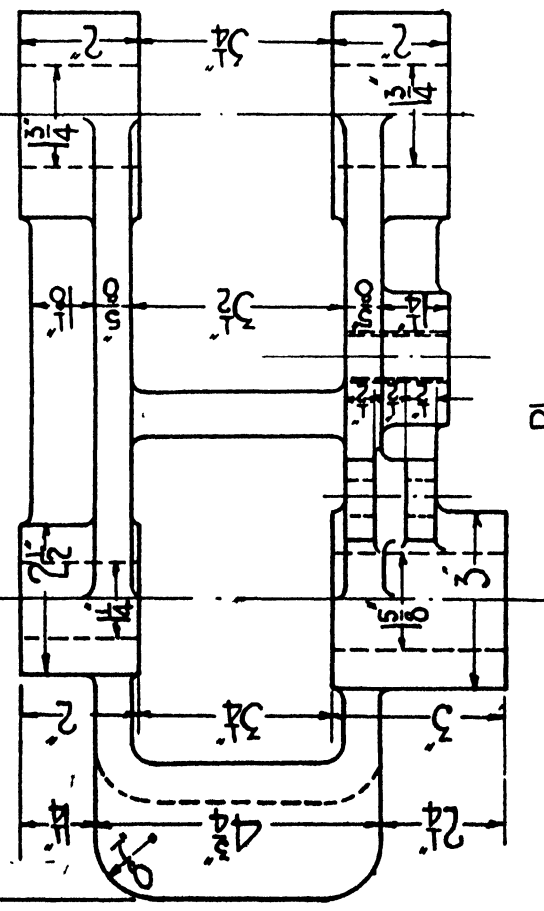
A

End elevation



Draw 9" = 1 foot

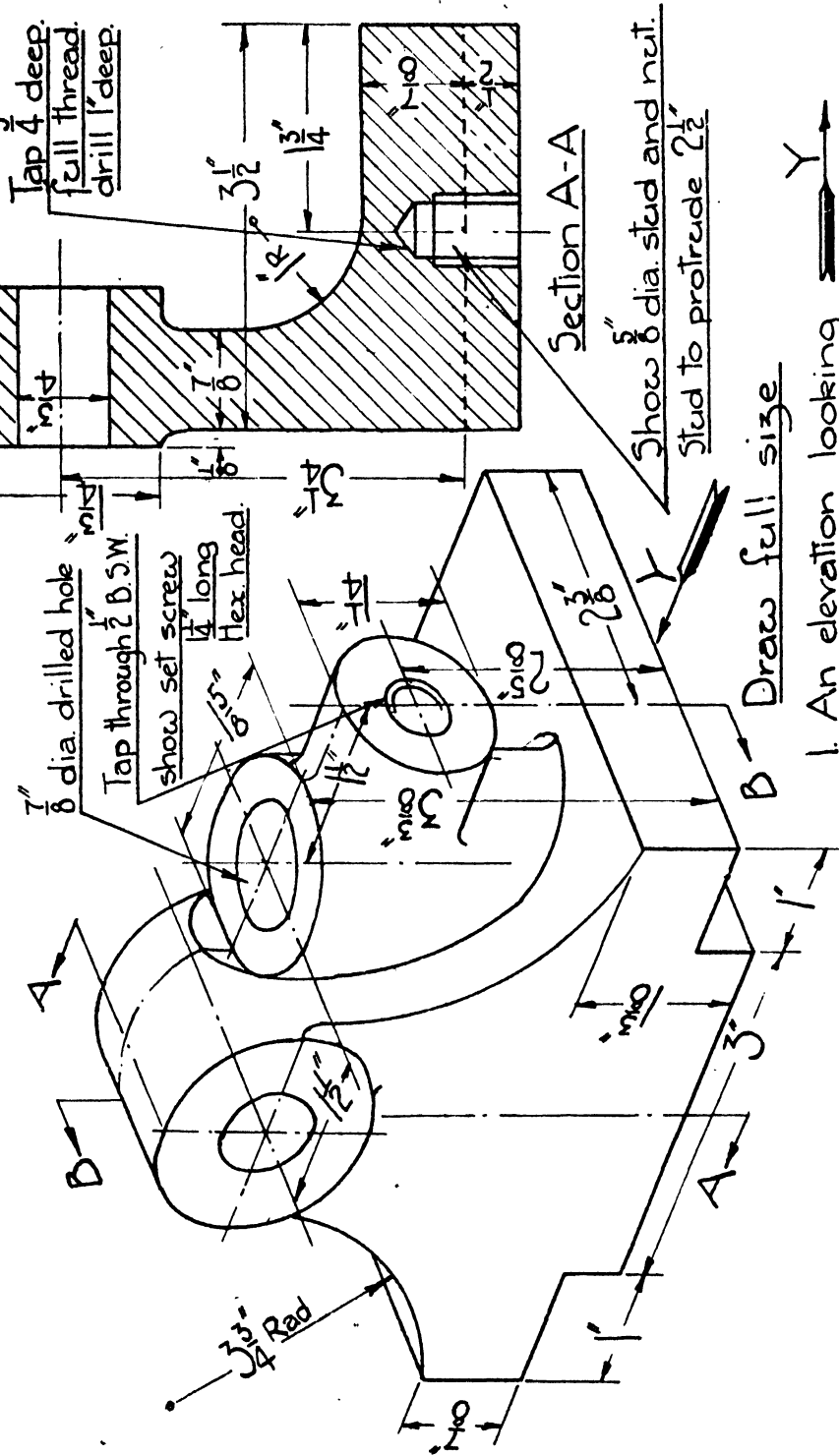
1. A front elevation
2. A sectional end elevation through A-A.
3. A sectional plan through B-B.




Plan

# LATHE BRACKET cast iron.

SHEET NO. 6.A.

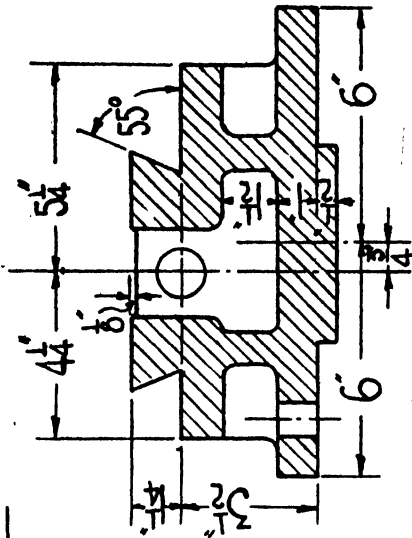


1. An elevation looking  Y
2. A sectional end elevation through B-B.
3. A plan.



# CROSS SLIDE for a 25" centre lathe. Cast iron

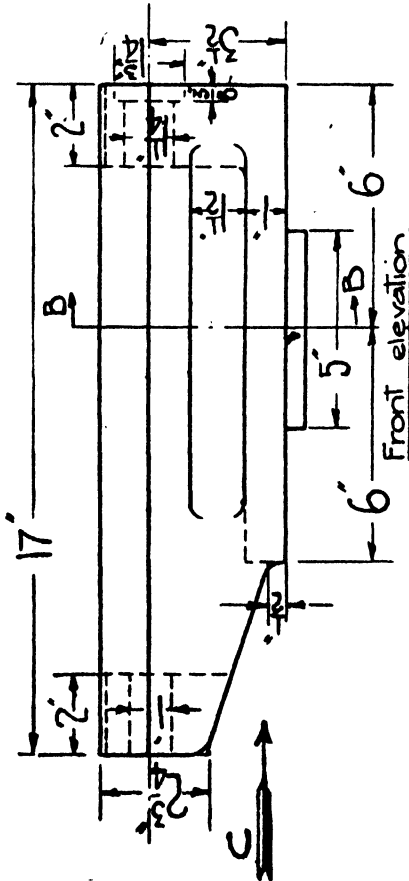
SHEET NO. 8 A.



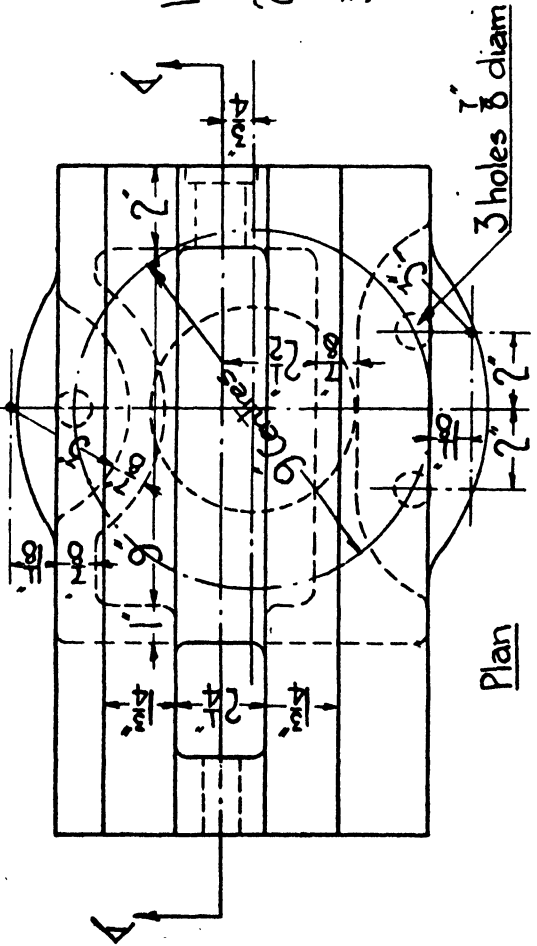
Sectional end elevation  
through B-B

Draw to scale of 6" = 1 foot

1. A sectional front elevation through AA
2. An end elevation looking C
3. A plan.

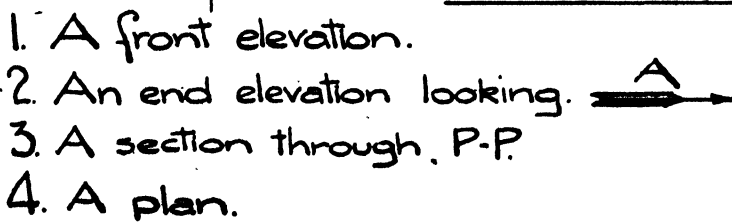


Front elevation



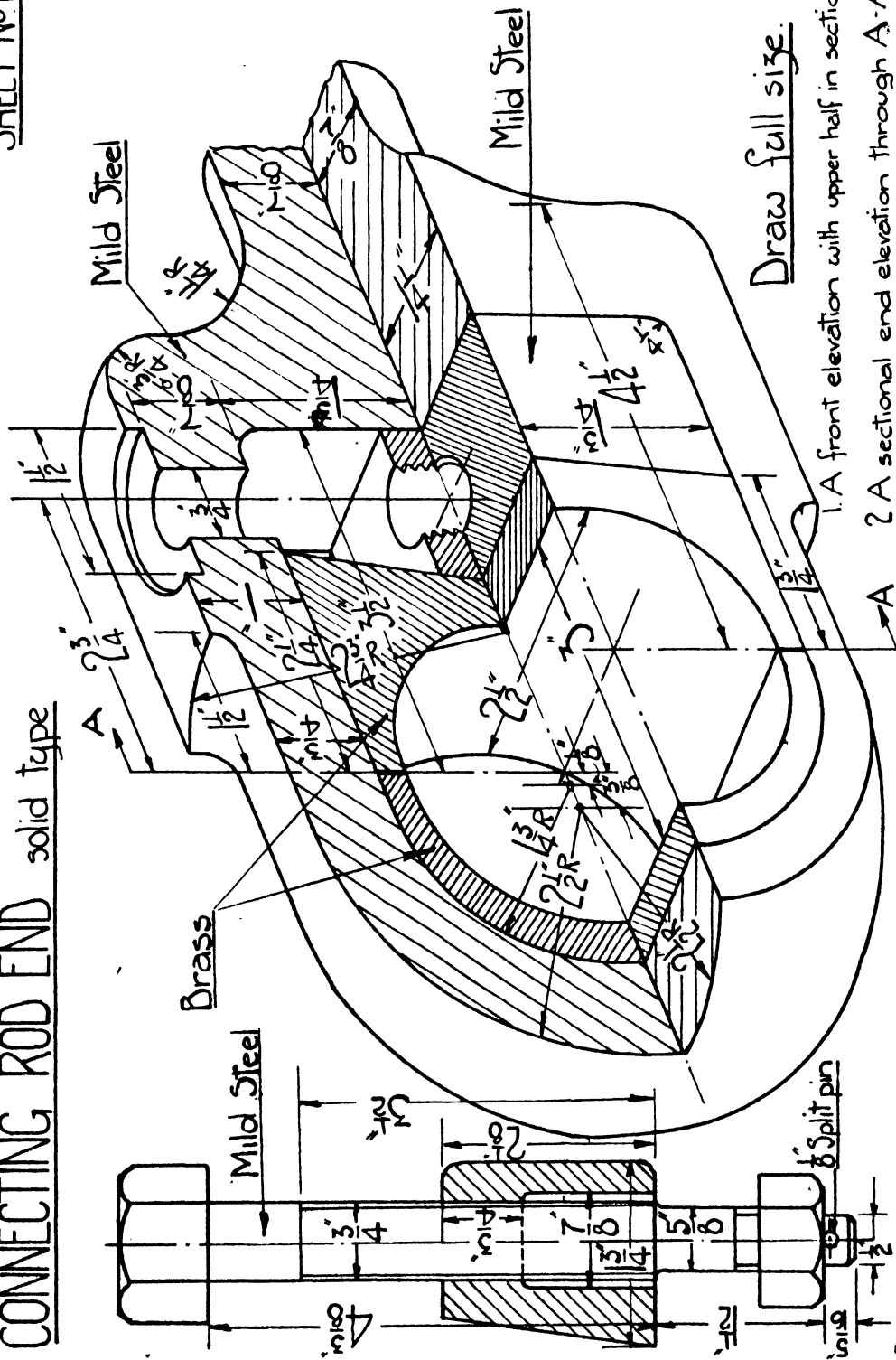
Plan

SHEET NO. 9.A.



# CONNECTING ROD END solid type

SHEET No 10A



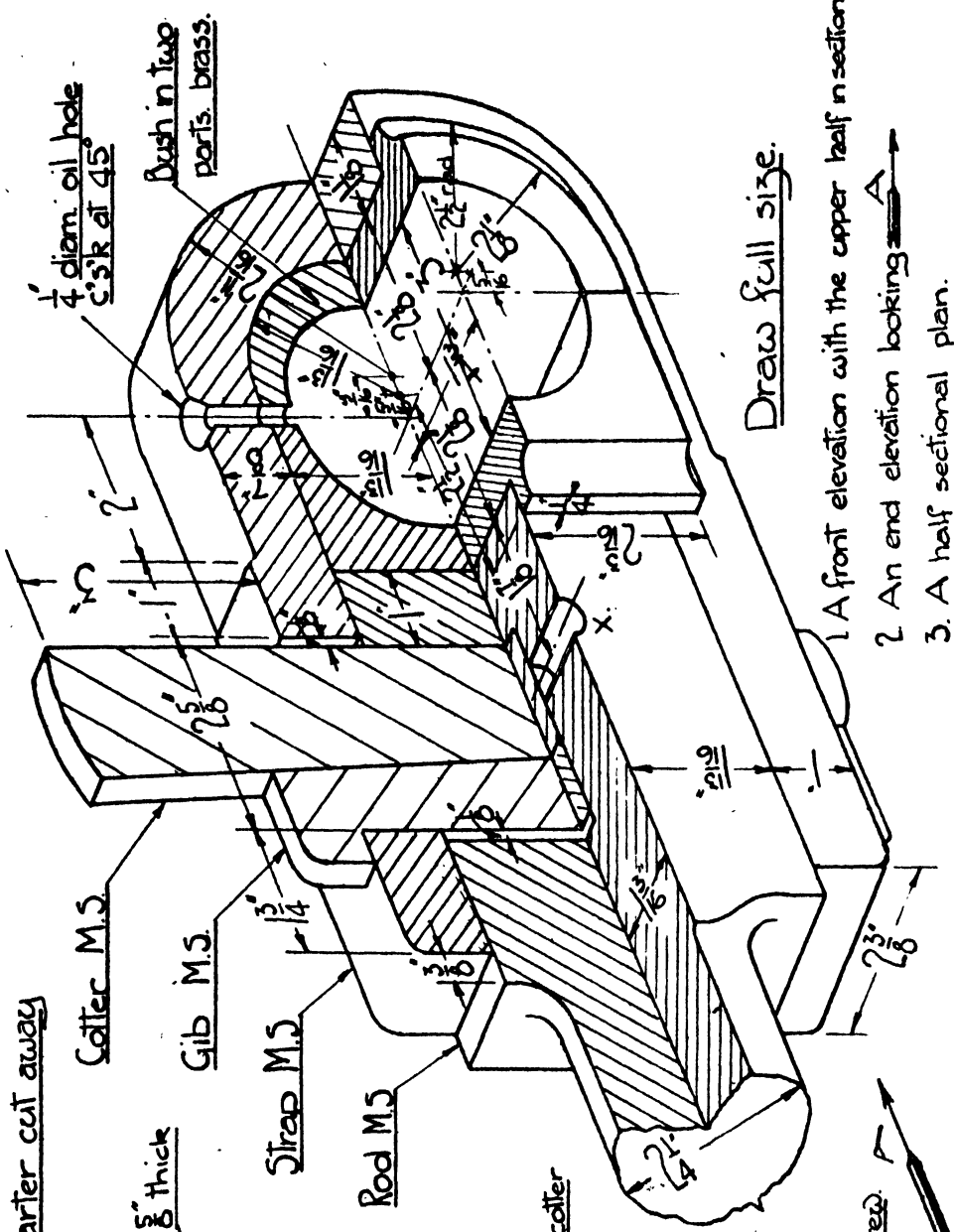
Draw full size.

Detail of bolt and block



# CONNECTING ROD END STRAP TYPE.

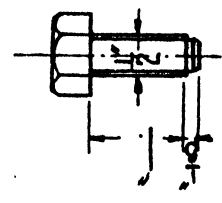
Shown with a quarter cut away



Draw full size.

- 1 A front elevation with the upper half in section
- 2 An end elevation looking  $\rightarrow$  A
- 3 A half sectional plan.

Detail of gib and cotter



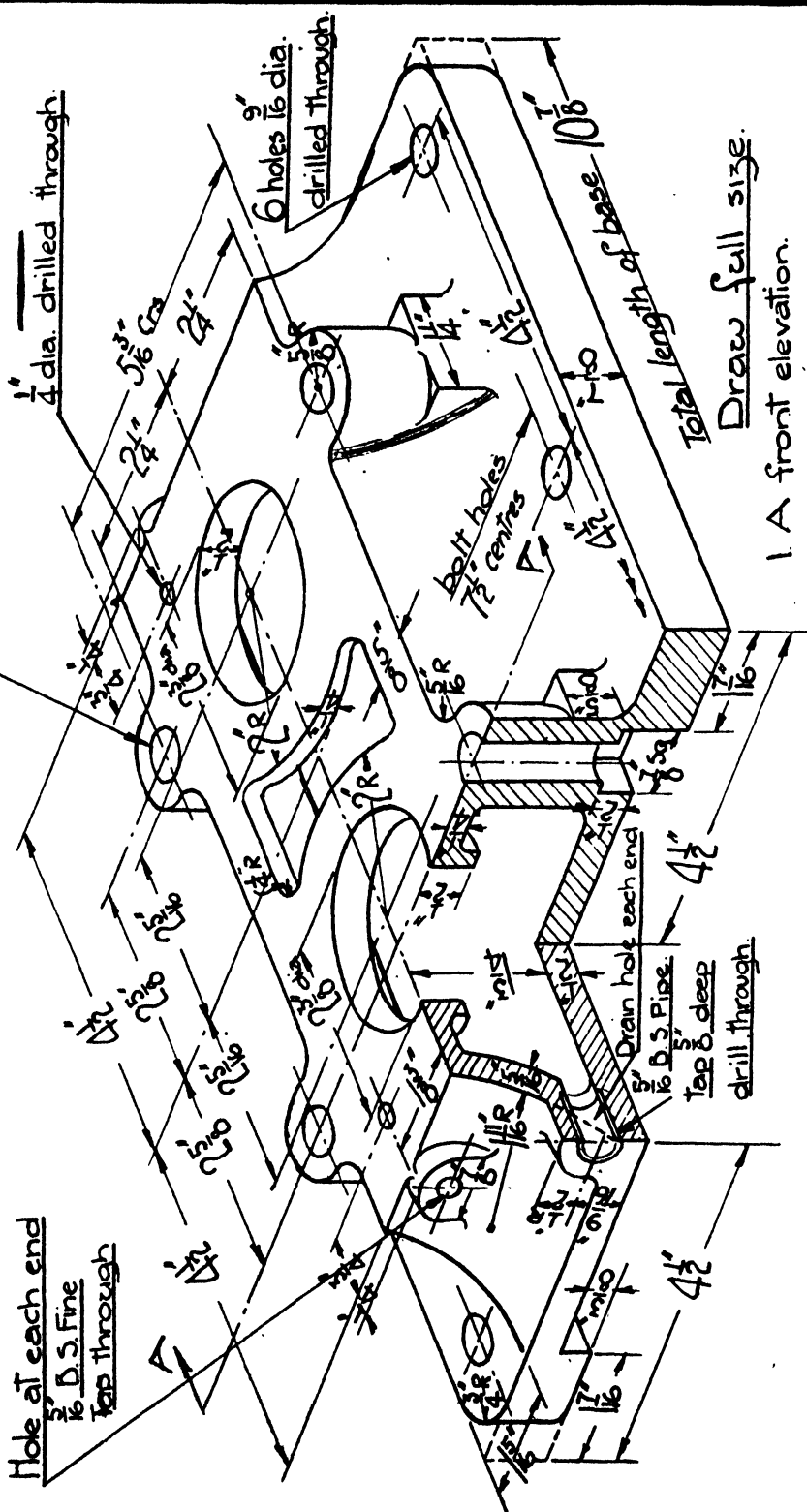
Detail of locking screw at X.





# PUMP BASEPLATE cast iron

SHEET NO 13A

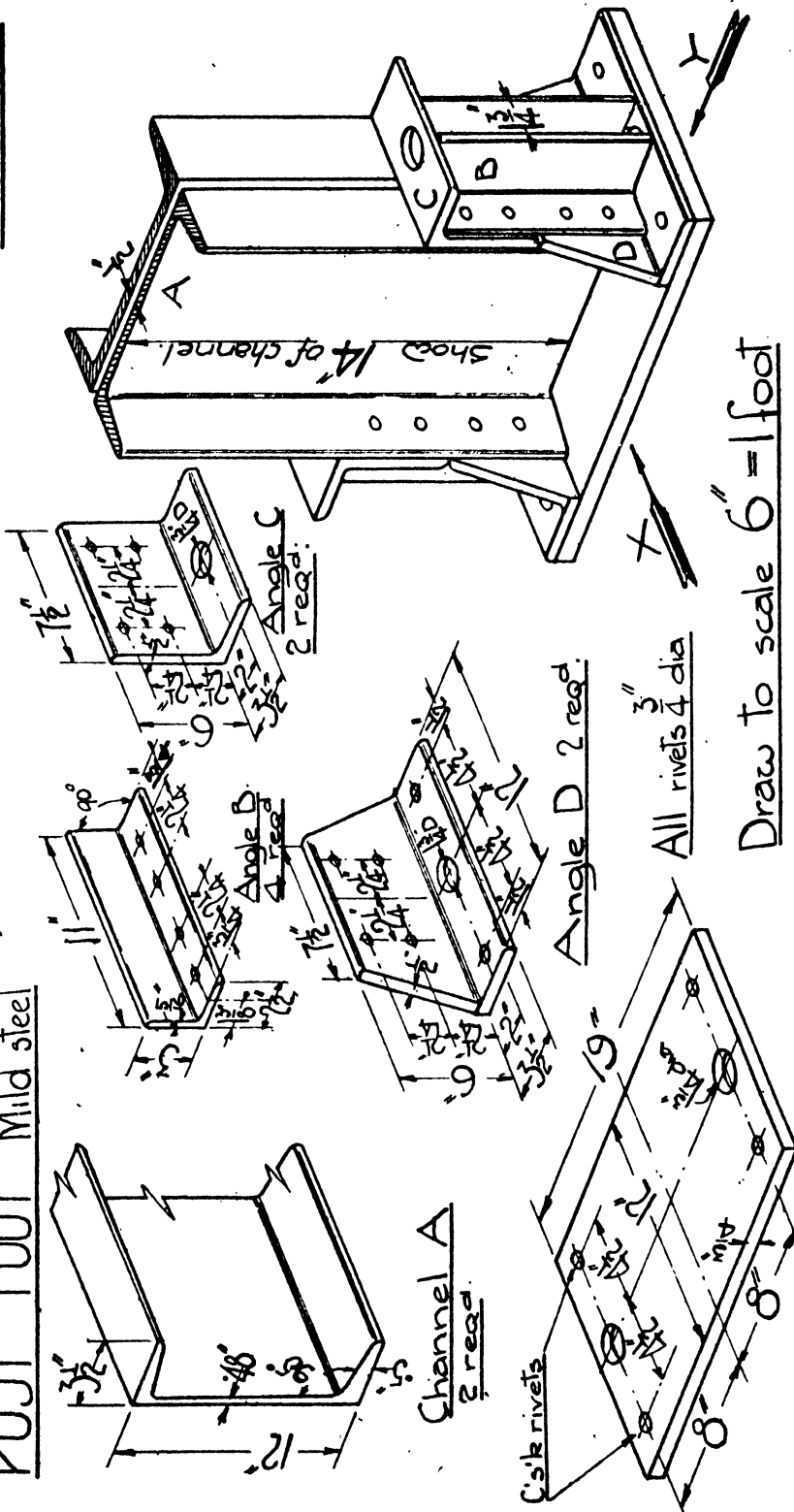


1. A front elevation.
2. A sectional end elevation through A-A
3. A complete plan.

# POST FOOT

Mild steel

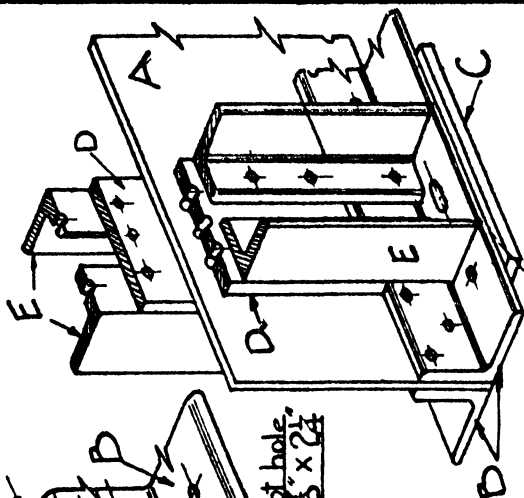
SHEET NO. 14A.



Draw to scale 6" = 1 foot

1. A front elevation looking X
2. An end elevation looking Y
3. A plan.

SHEET NO. 15A



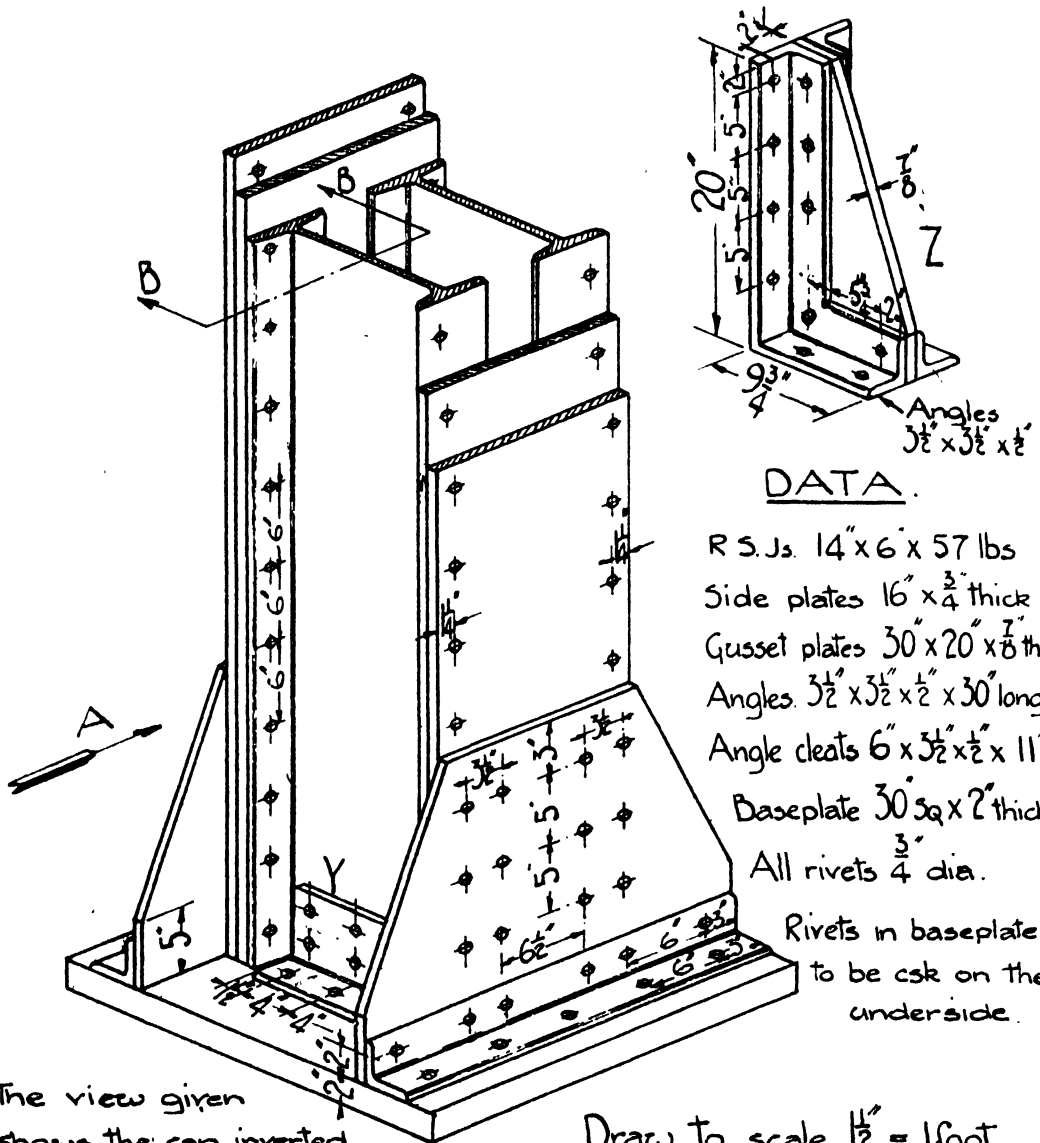
All rivets 8 dia.

Draw 3'-1 foot.

1. A front elevation.
2. An end elevation.
3. A plan.

CAP & BASE for STANCHION. Mild steel.

SHEET NO. 16A




The view given shows the cap inverted.

The base is similar except that the gussets Z are substituted for the angles Y, and ? provision should be made

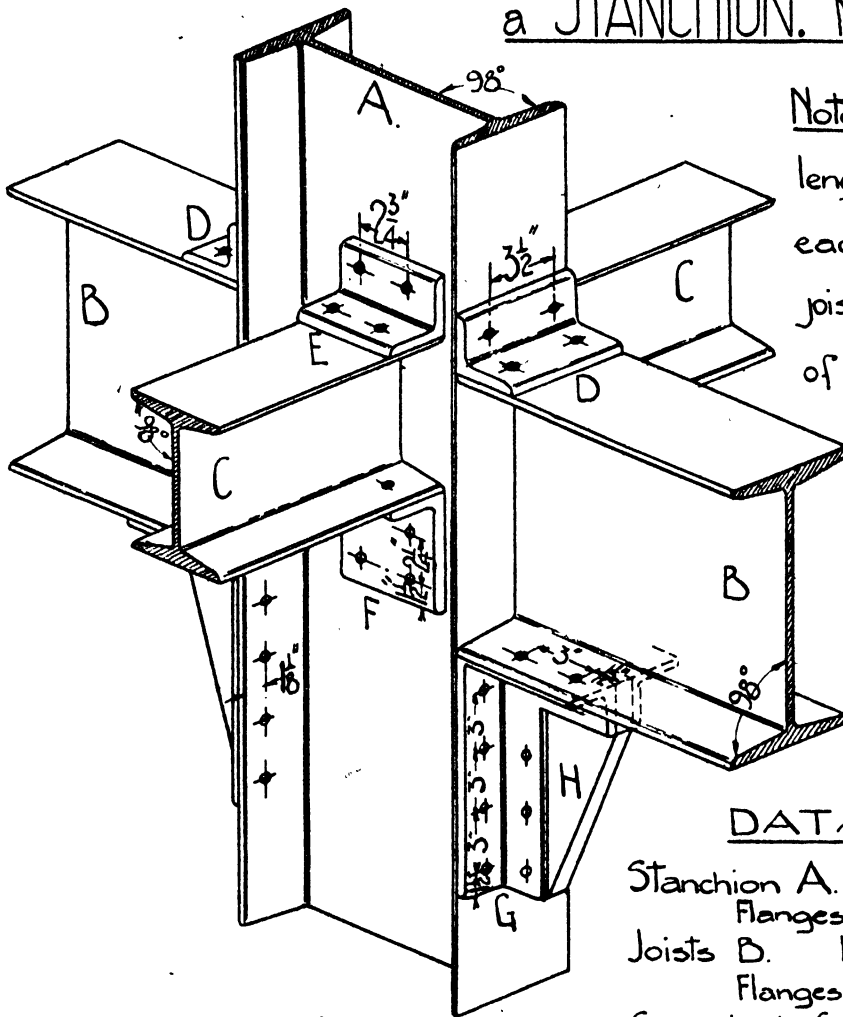
for 4 bolt holes  $\frac{1}{2}$ " dia  
 $22\frac{3}{4}$ " x 18" centres

Draw to scale  $1\frac{1}{2}" = 1\text{foot}$ .

1. An elevation of cap, and base in correct relative position looking 

# CONNECTIONS of FLOOR JOISTS to a STANCHION. Mild steel.

SHEET NO 17.A.



Note:- Show a length of 12" for each horizontal joist, and a length of 4 ft. for stanchion.

## DATA.

Stanchion A. 12" x 6" x 54 lbs.  
Flanges .863" Web .5".

Joists B. 14" x 6" x 57 lbs.  
Flanges .873" Web .5".

Cross Joists C. 8" x 5" x 28 lbs.  
Flanges .575" Web .35".

Angles D. 3" x 3" x 1/2" x 6" long.

Angles E. 3" x 3" x 1/2" x 5" long.

Angles F. 6" x 3" x 1/2" x 5" long.

Angles G. 2 1/2" x 2 1/2" x 3/8" bent  
at right angle 12" x 6"

Gusset plates H. 12" x 6" x 1" thick.

All bolts and rivets 3/4" dia.

Bolts shown ●.

Rivets shown ○.

Draw to scale 1 1/2" = 1 foot.

1. A front elevation.

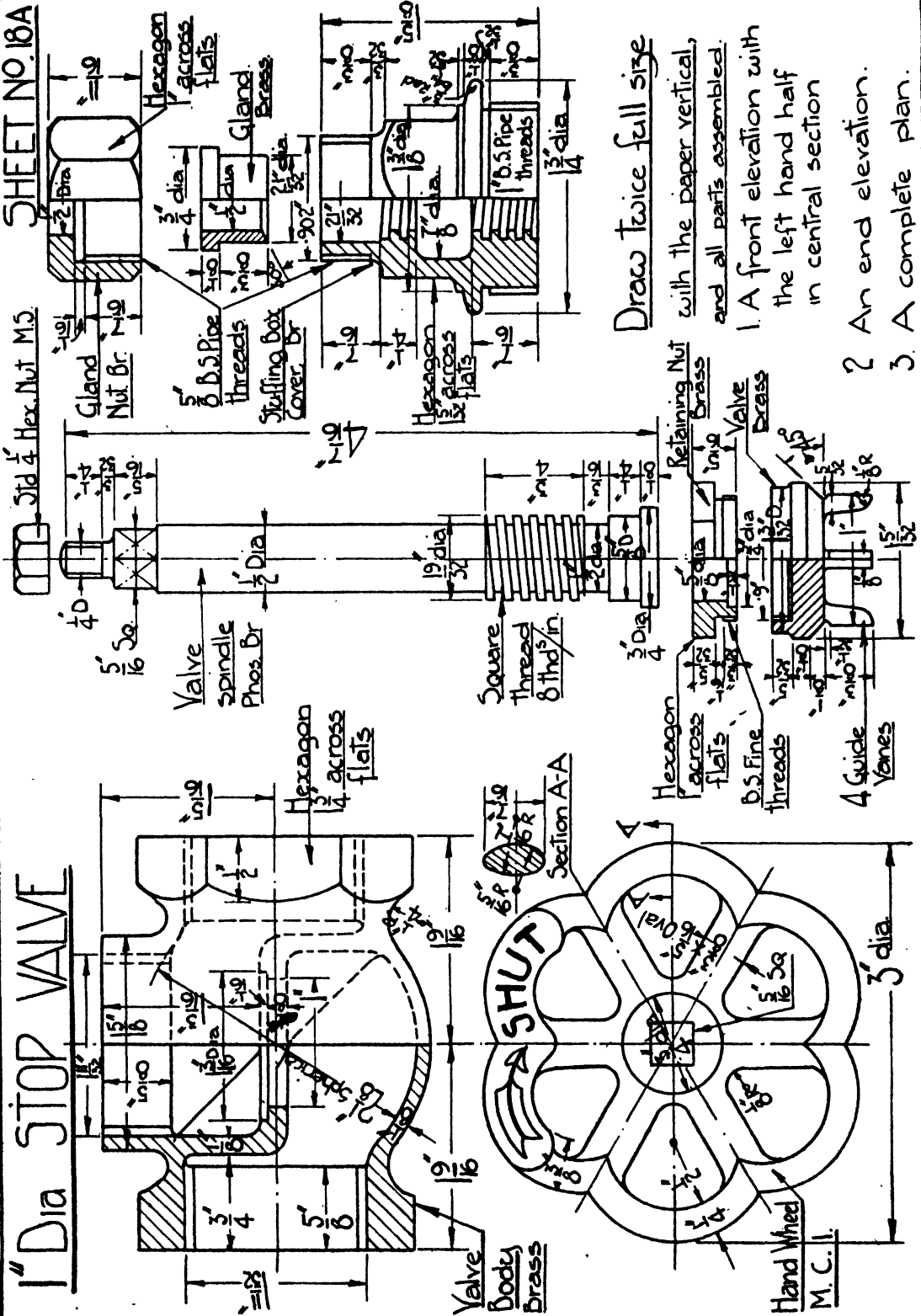
2. An end elevation.

3. A plan.

1" Dia STOP VALVE

SHEET NO. 18A

1 1/4 Hex. Nut M.S.



### Draw twice full size

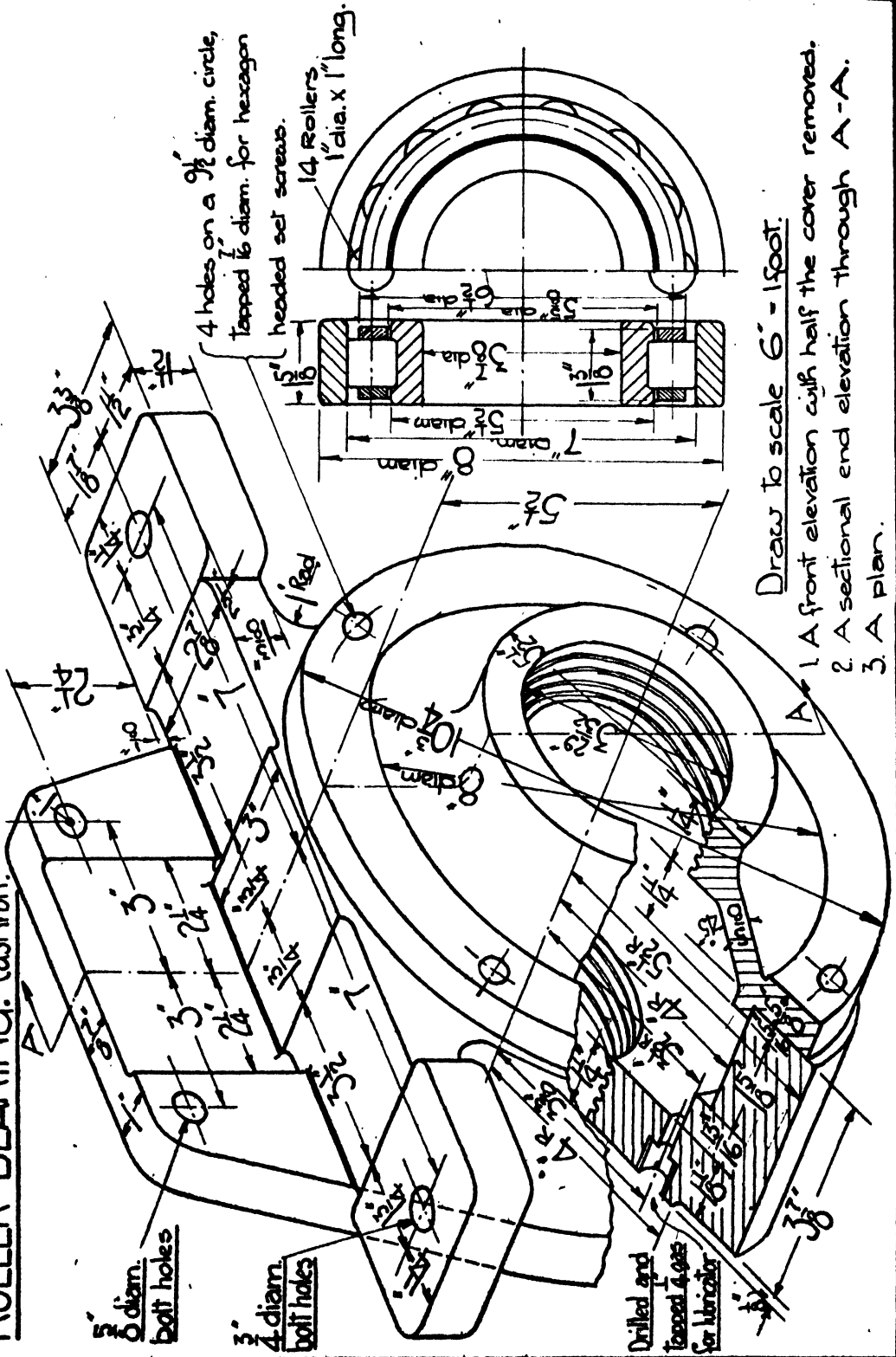
with the paper vertical,  
and all parts assembled.

1. A front elevation with the left hand half in central section
2. An end elevation.
3. A complete plan.



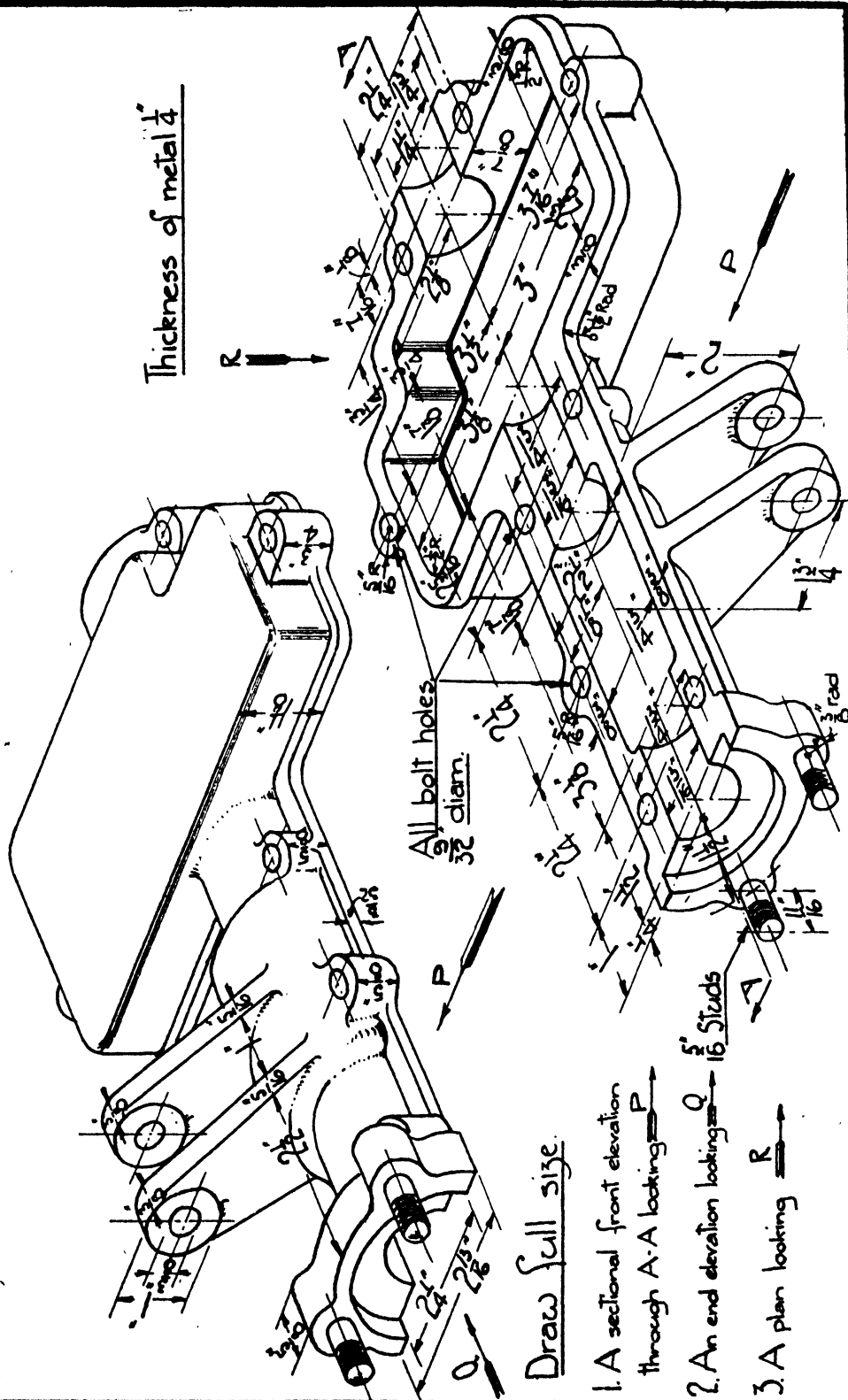
# ROLLER BEARING. Cast iron.

SHEET NO. 19A.



# AERO GEAR COVER Alum. alloy

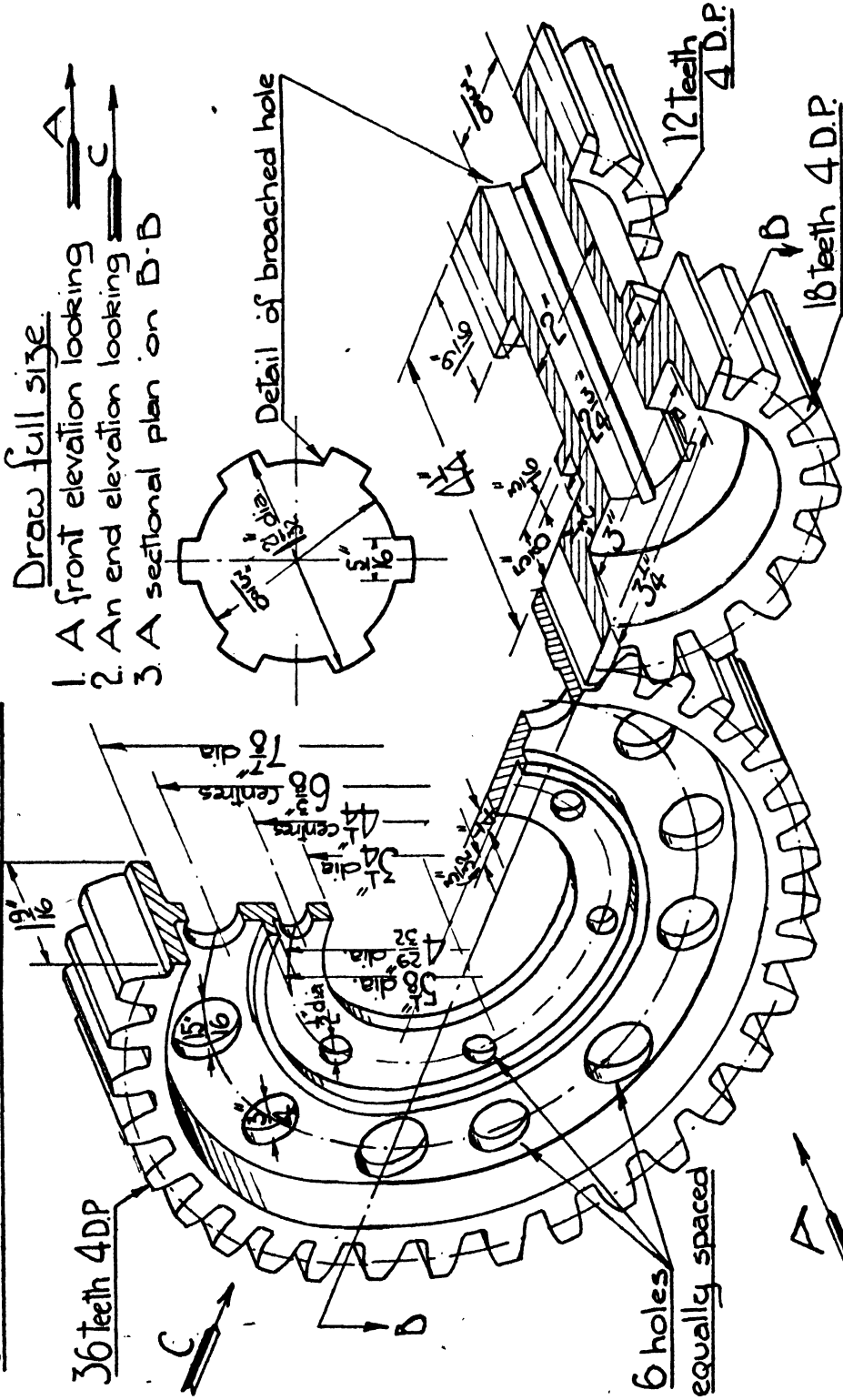
SHEET NO. 20A.



# SPUR GEAR WHEELS

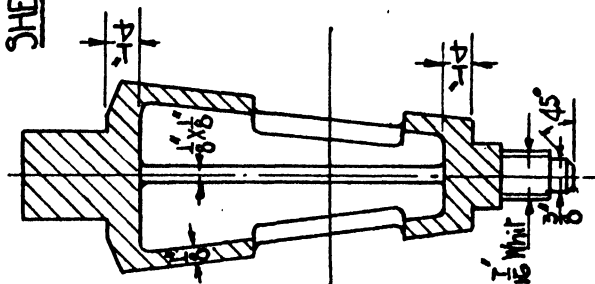
Mild Steel

SHEET No. 21.A



# PLUG VALVE & PIPE UNION.

SHEET NO 22A.



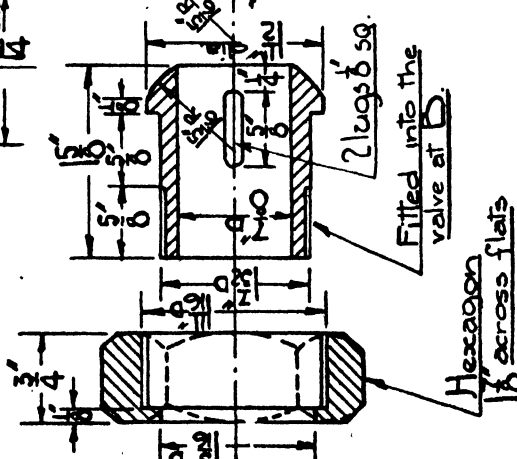
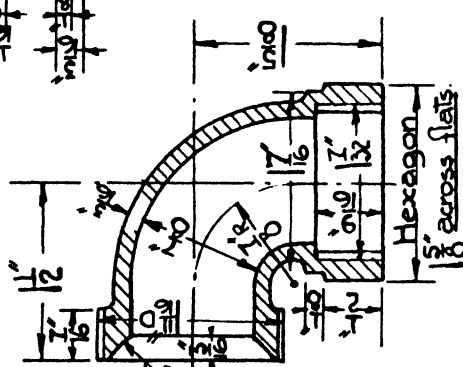
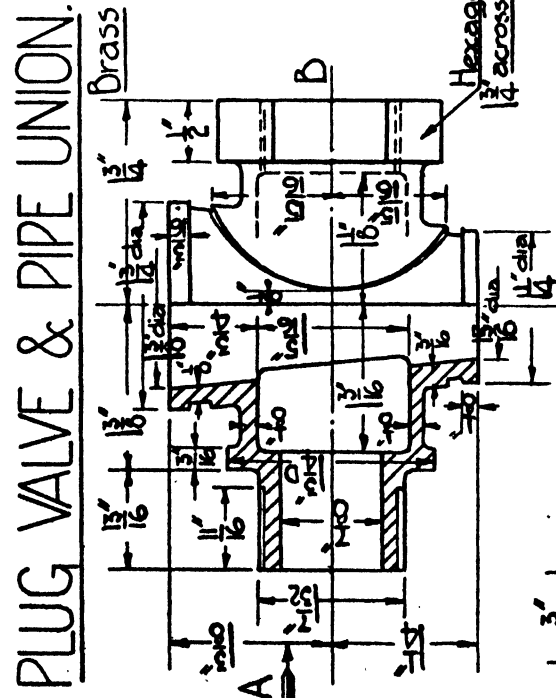
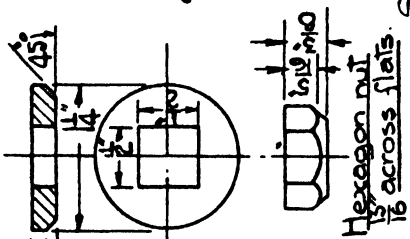
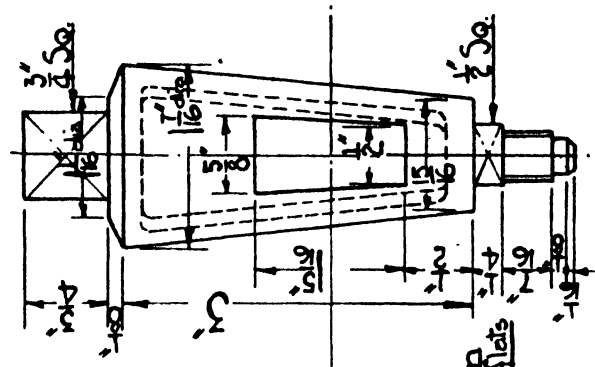
Draw twice full size

1. A sectional front elevation with all parts assembled.
2. An end elevation looking  $\Delta$
3. A plan.

OR

Draw full size.

Sufficient views of each part to make a workshop drawing







# AUTOMATIC LUBRICATOR for Gas Engine.

SHEET NO. 25A

Shown with parts cut away

Wiper of twisted copper  
wire  $\frac{1}{16}$  diam.  
or 16 S.W.G.

M.S. Pin  $\frac{1}{4}$  diam x 1" long  
screwed into body

Belt pulley C.I.  
keyed to shaft  
with  $\frac{1}{8}$  diam.  
taper key  
1" long.

Boss  $\frac{3}{4}$  diam.

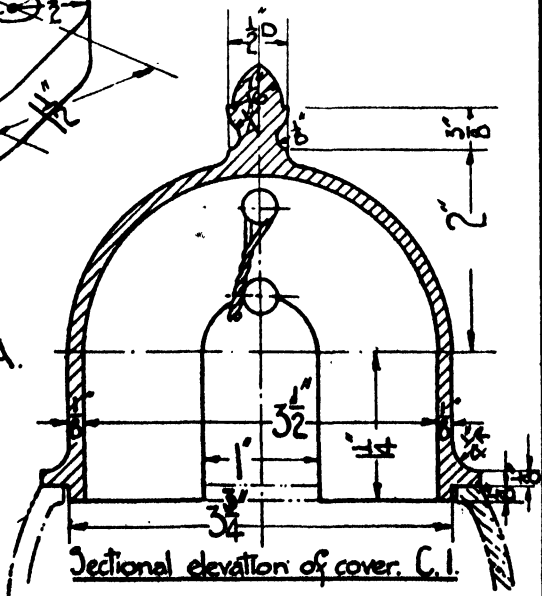
M.S. Pillar screwed  
into body

Body cast iron.

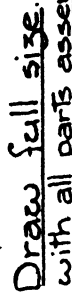
Tapped  
 $\frac{1}{4}$  Gas


Draw full size with cover in position

1. A sectional front elevation through A-A.
2. An end elevation looking  $\rightarrow$  D without cover.
3. A complete plan.



SHEET NO. 26A



1. A section through A-A.
2. An end elevation looking B without cover 
3. A section through C-C.
4. A plan.

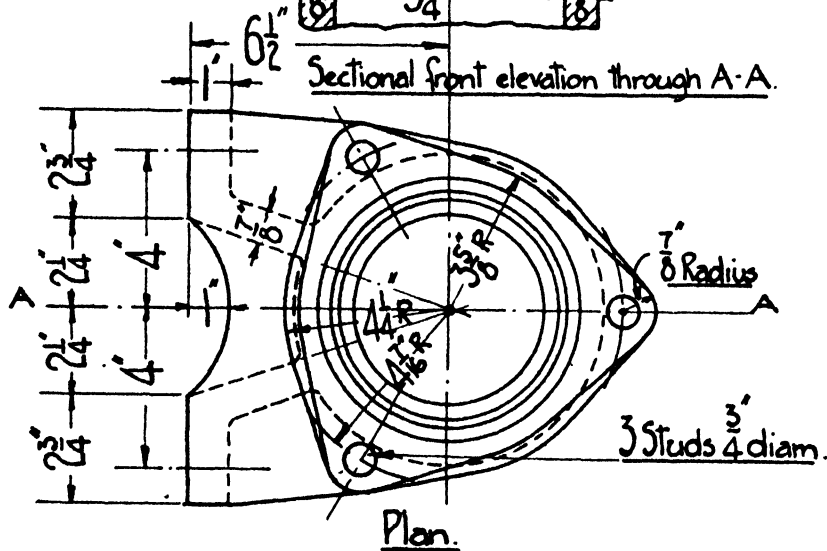
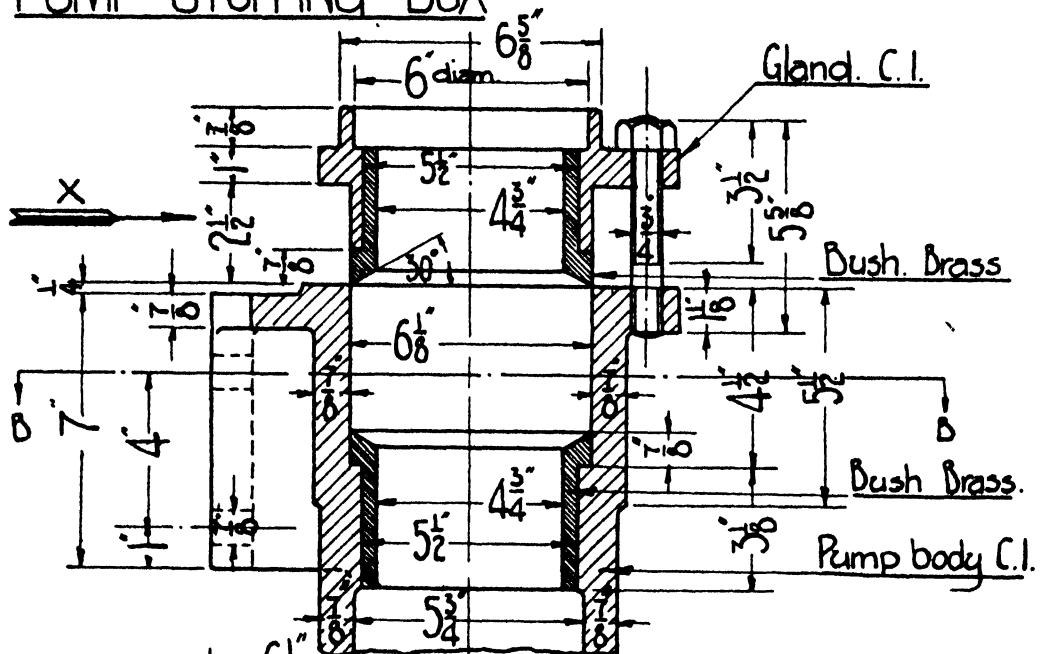
Detail of spur gear  
10 teeth .314 Arc pitch

Cover C.I.




# PUMP STUFFING BOX

SHEET NO. I.B.



Draw to scale of 6" = 1 foot.

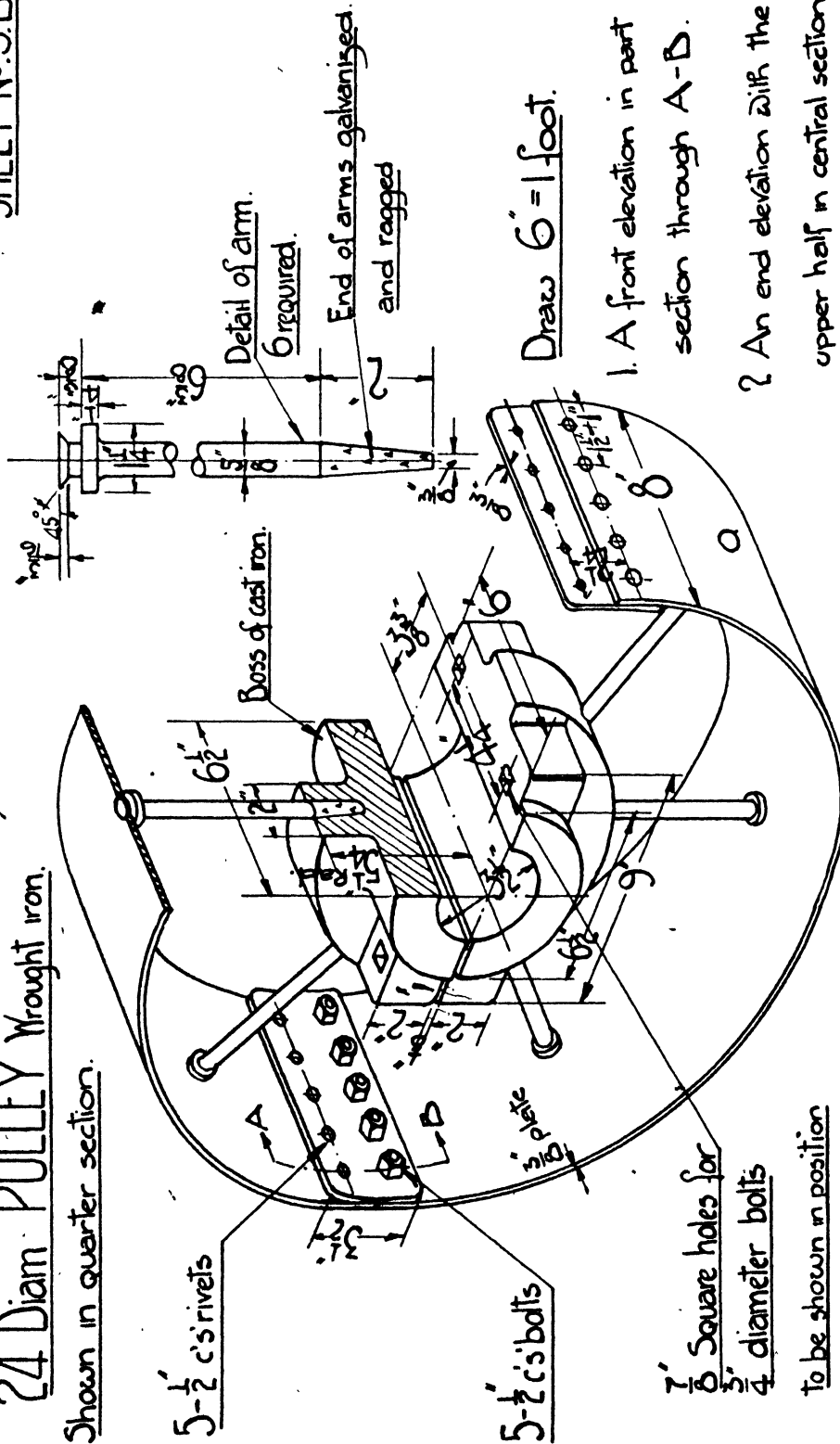
1. A sectional front elevation through A-A.
2. A sectional plan through B-B.
3. An end elevation looking in direction 



SHEET NO. 3.B.

24" Diam PULLEY Wrought iron.

Shown in quarter section.

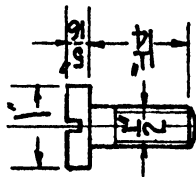
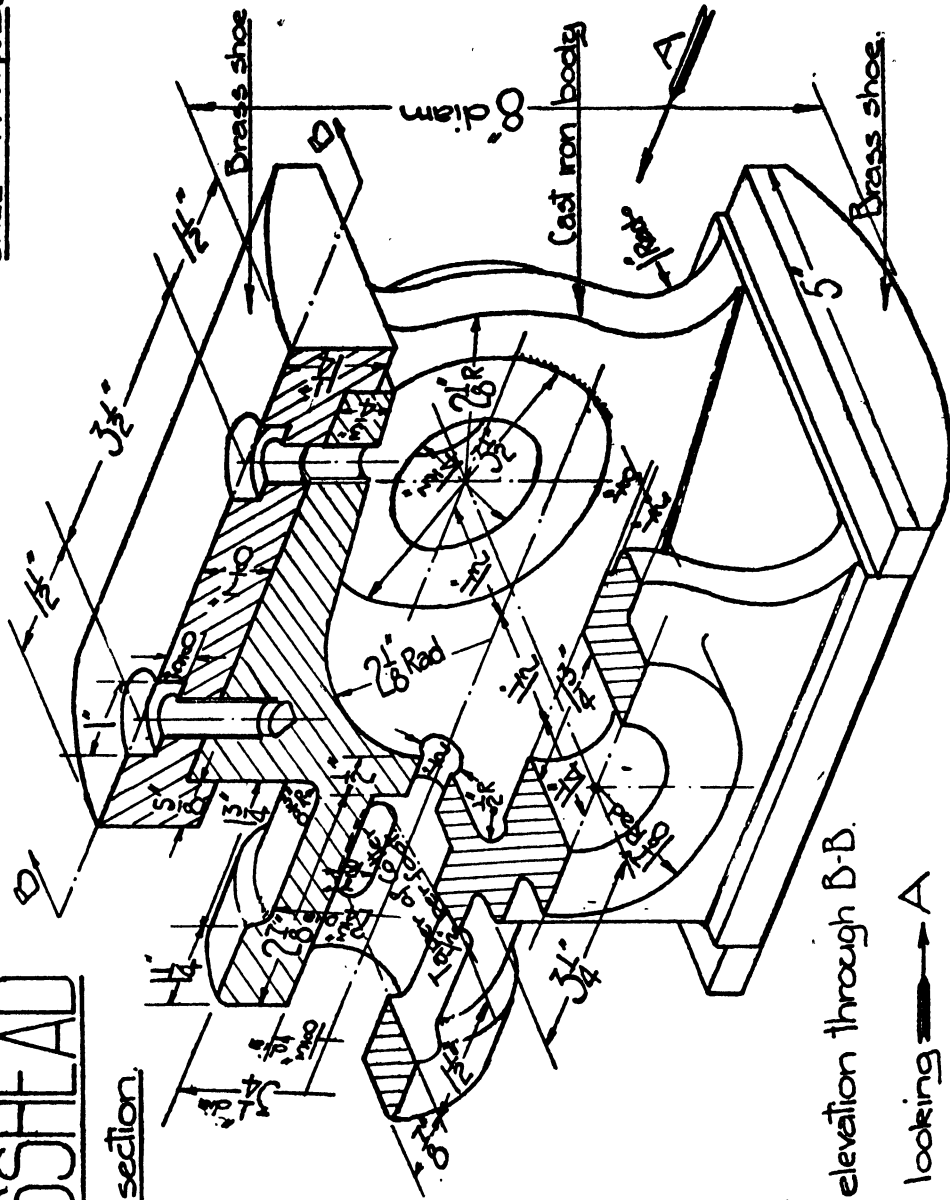


Draw  $6'' = 1 \text{ foot.}$

1. A front elevation in part section through A-B.
2. An end elevation with the upper half in central section

# PUMP CROSSHEAD

Shown in quarter section.

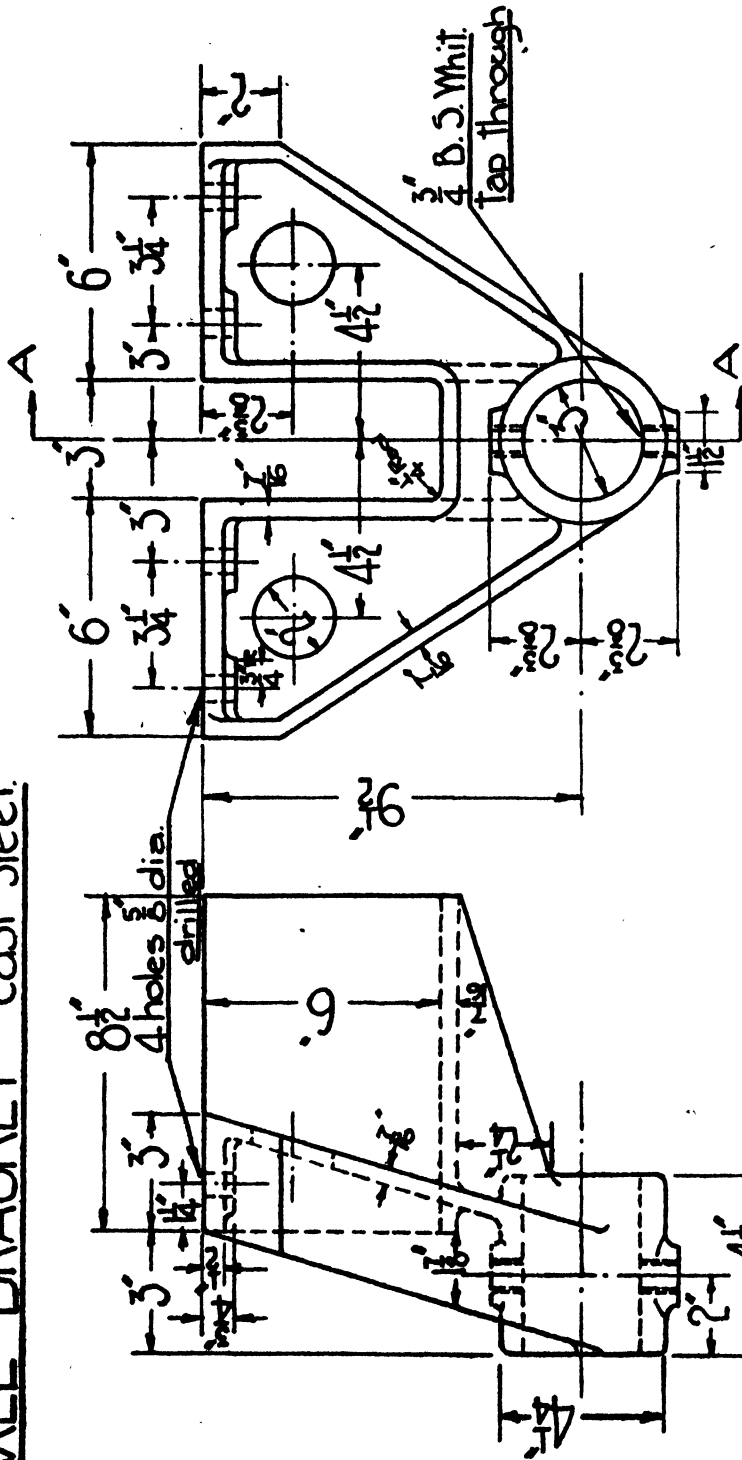


Detail of set screw.  
4 required M.S.  
To be shown fixed  
in position

Draw full size.

1. A sectional front elevation through B-B.
2. An end elevation looking  $\longrightarrow$  A
3. A complete plan

AXLE BRACKET cast steel

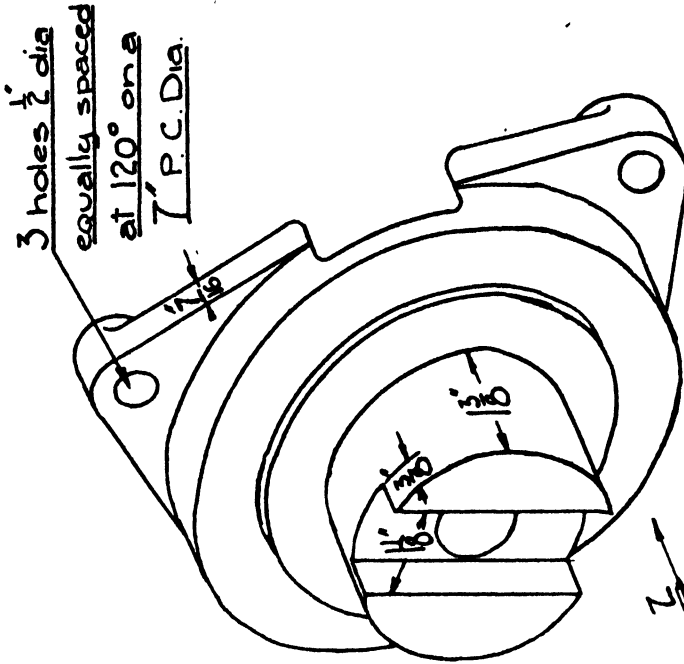


Draw half full size.




1. A front elevation.
2. A sectional end elevation through A-A.
3. A plan projected from front elevation.

SHEET No 6.B.

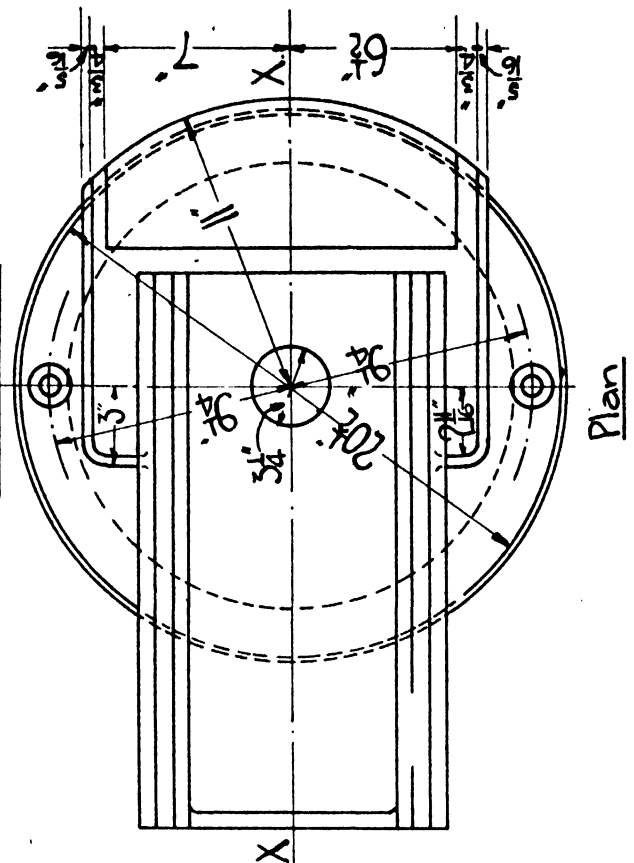
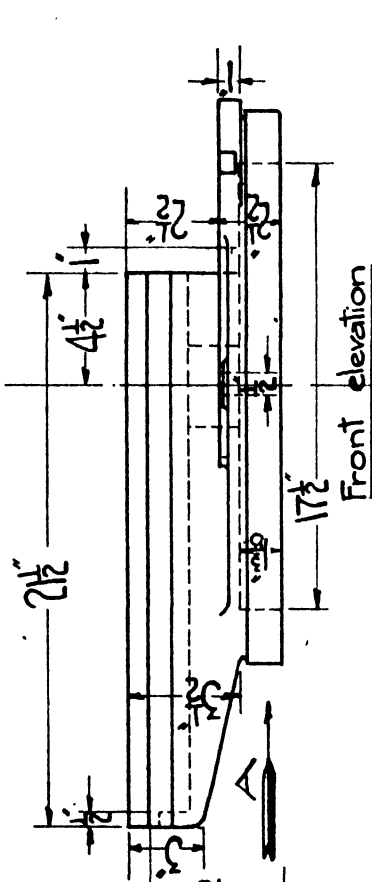
Mild steel.




Draw full size.

1. A sectional elevation looking 
2. An elevation looking 
3. An elevation looking 
4. A plan projected from elevation No 3.

SHEET NO 78.

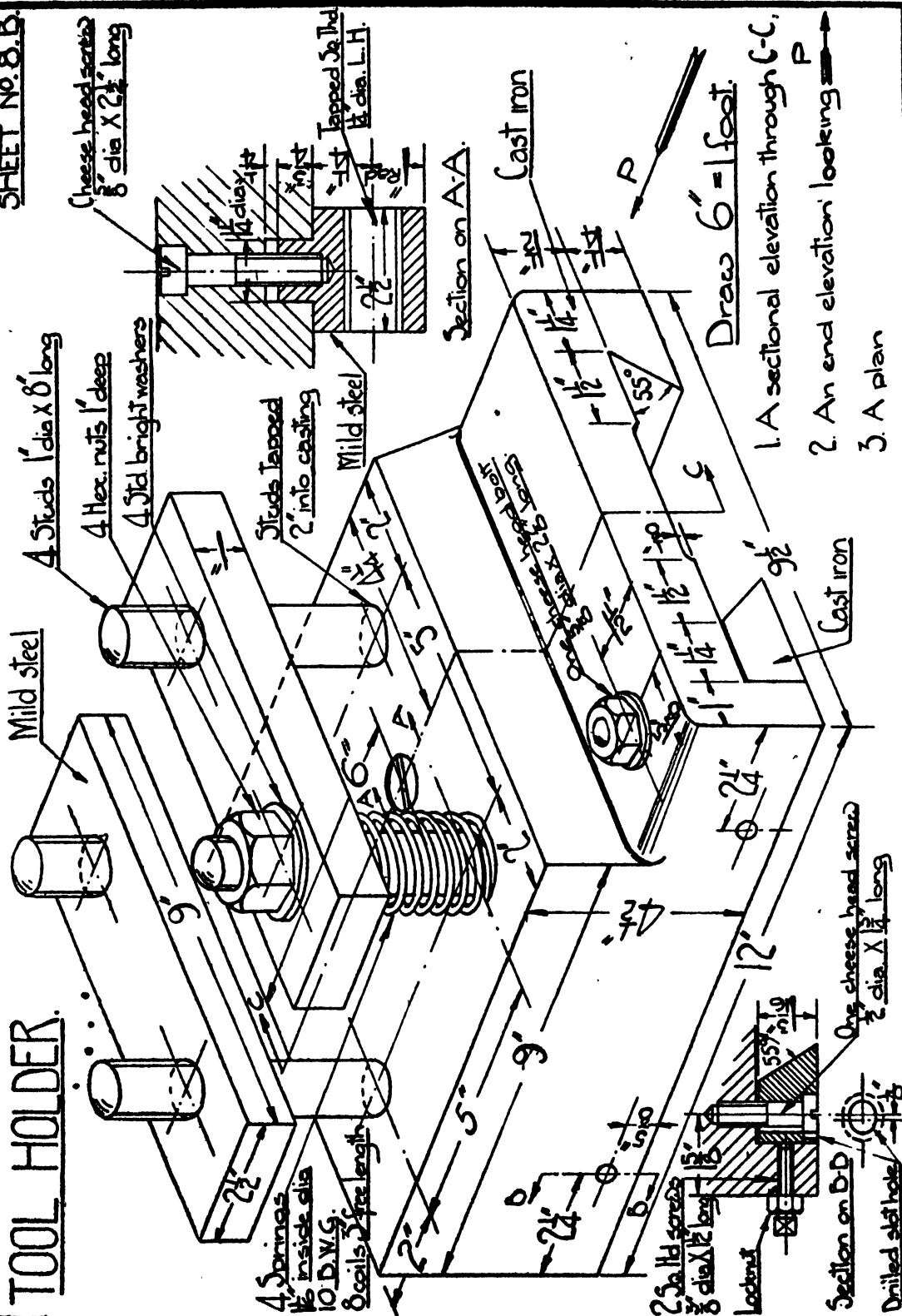



Draw to scale of  $4\frac{1}{2}'' = 1\text{ foot}$

1. A sectional front elevation through X-X.
2. An end elevation looking 
3. A plan.

# TOOL HOLDER:

**SHEET NO. 8. B.**

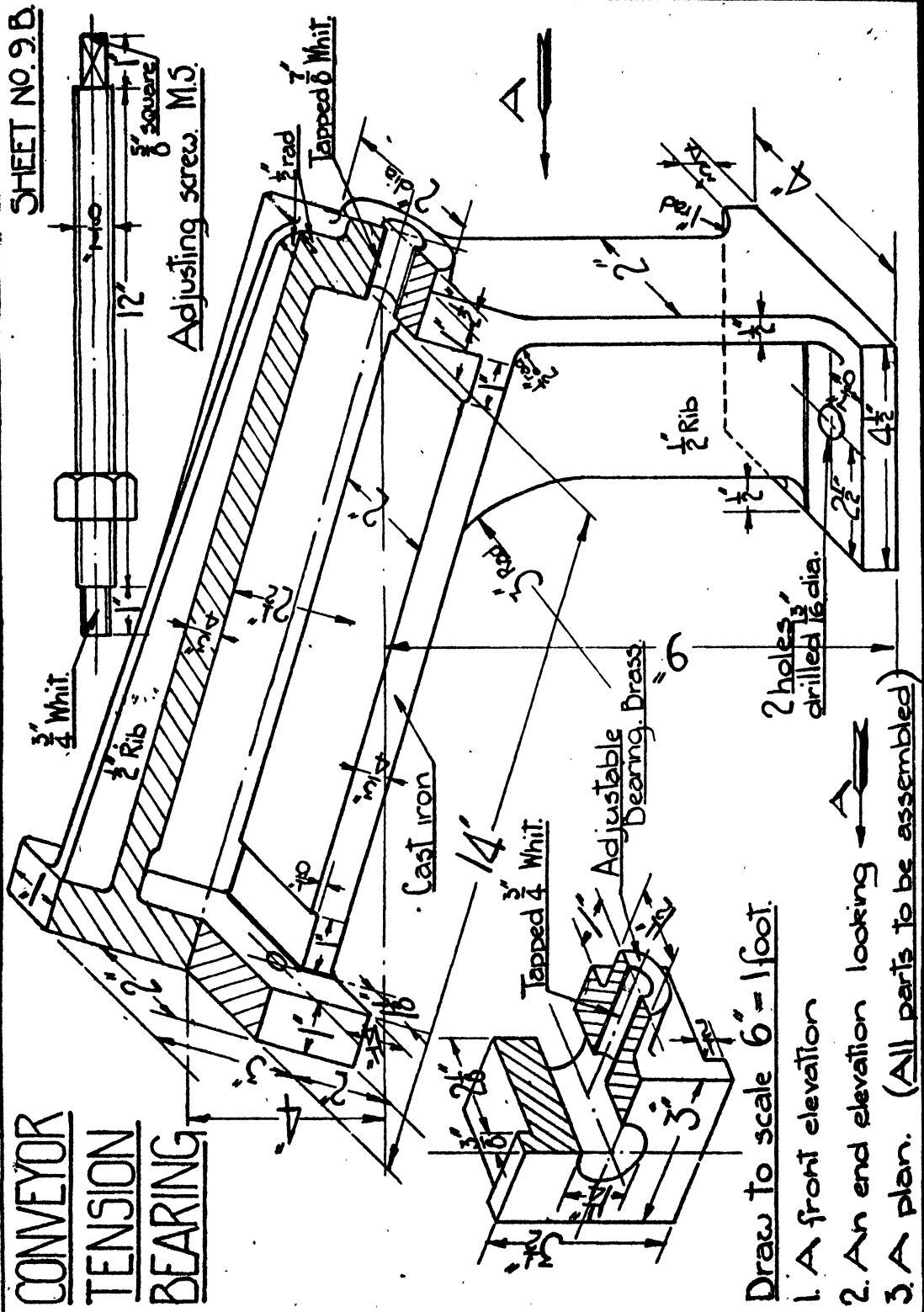


1. A sectional elevation through C-C,
2. An end elevation looking 
3. A plan



# CONVEYOR TENSION BEARING

SHEET NO. 9 B



Draw to scale 6" = 1 foot.

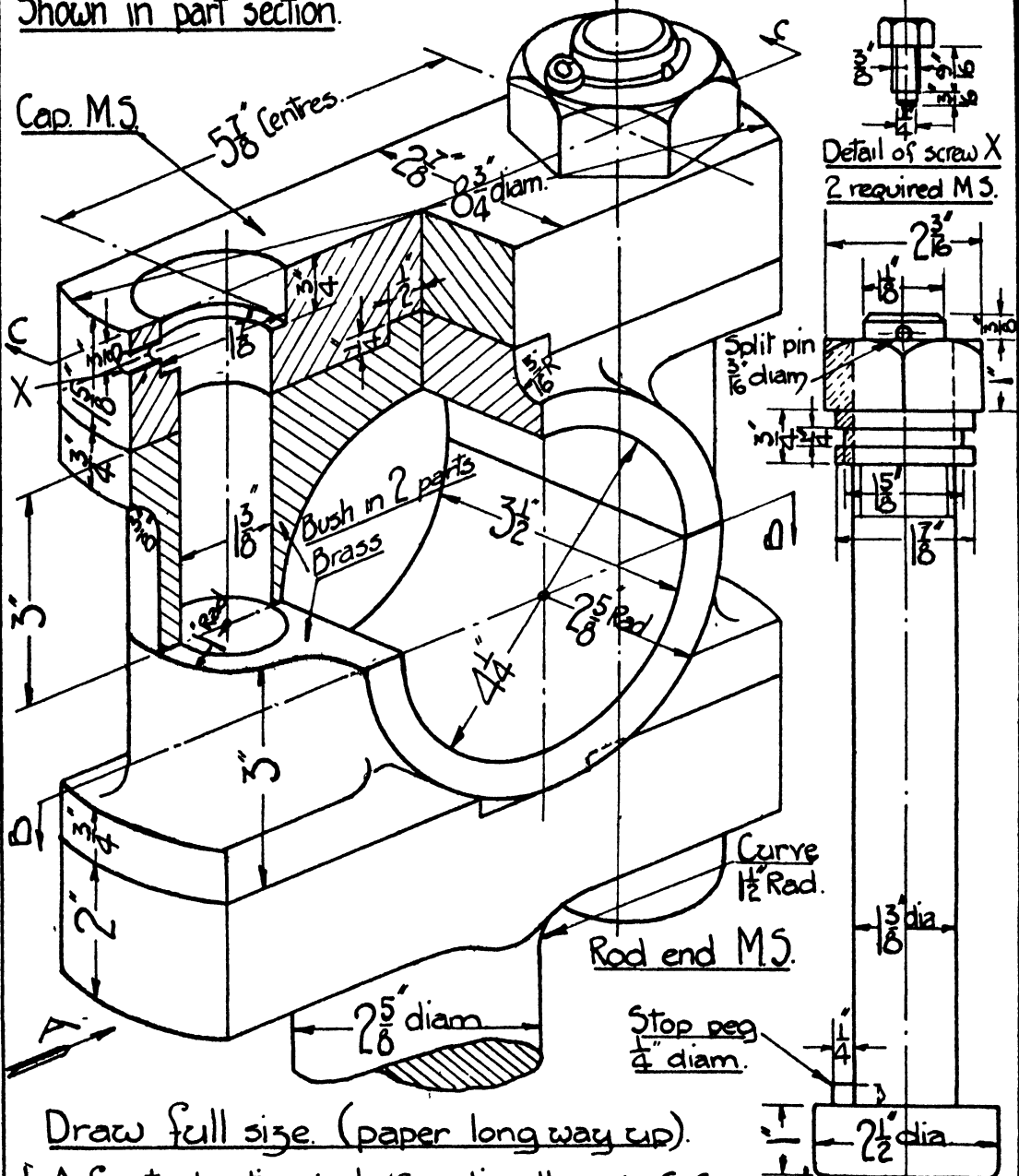
1. A front elevation
2. An end elevation looking ← A
3. A plan. (All parts to be assembled)

# CONNECTING ROD END


MARINE TYPE

SHEET NO. 10.B

Shown in part section.



Draw full size. (paper long way up).

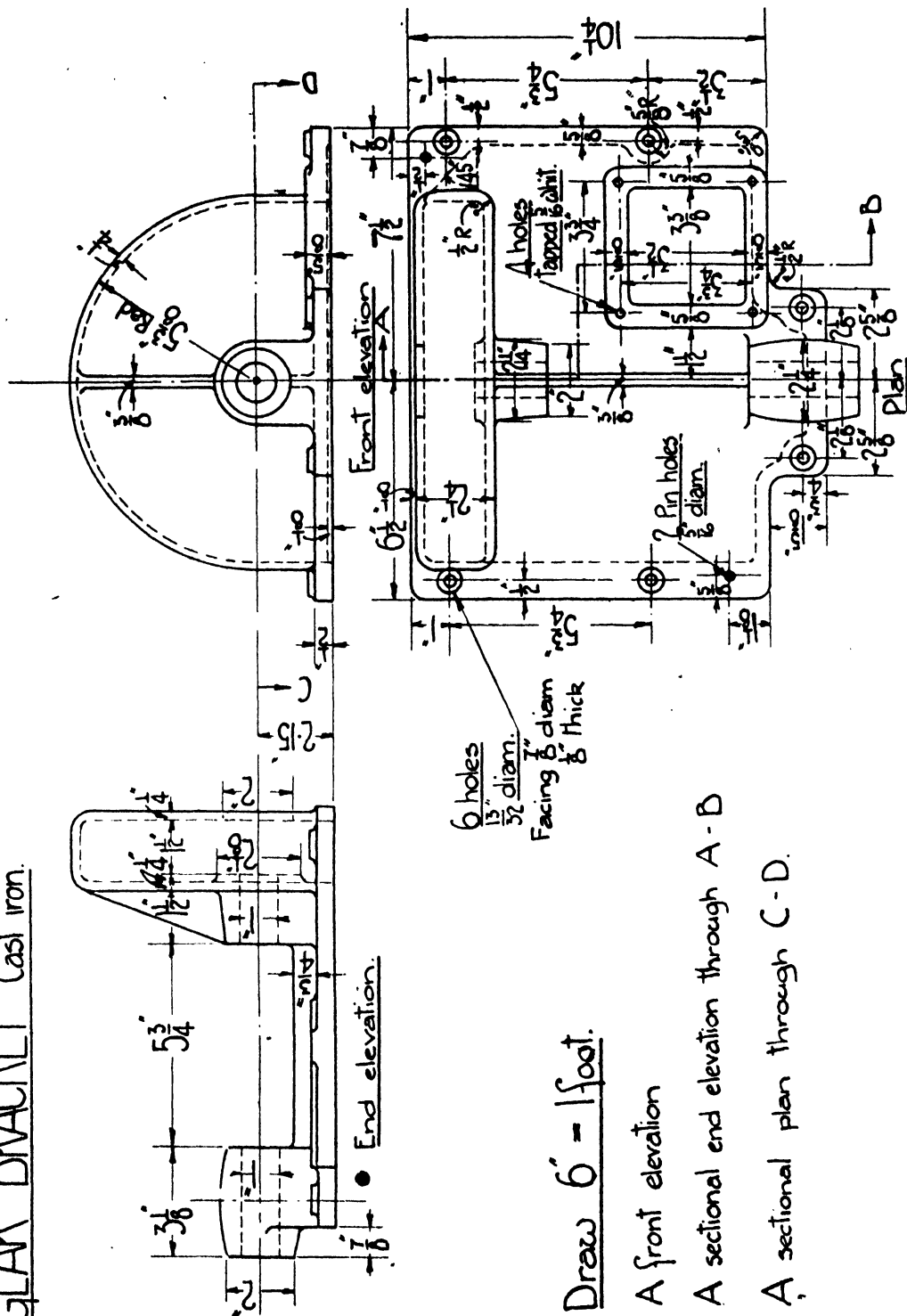
1. A front elevation in half section through C-C.
2. An end elevation looking 
3. A plan in half section through B-B

Detail of bolt.  
2 required M.S.



# GEAR BRACKET Cast iron.

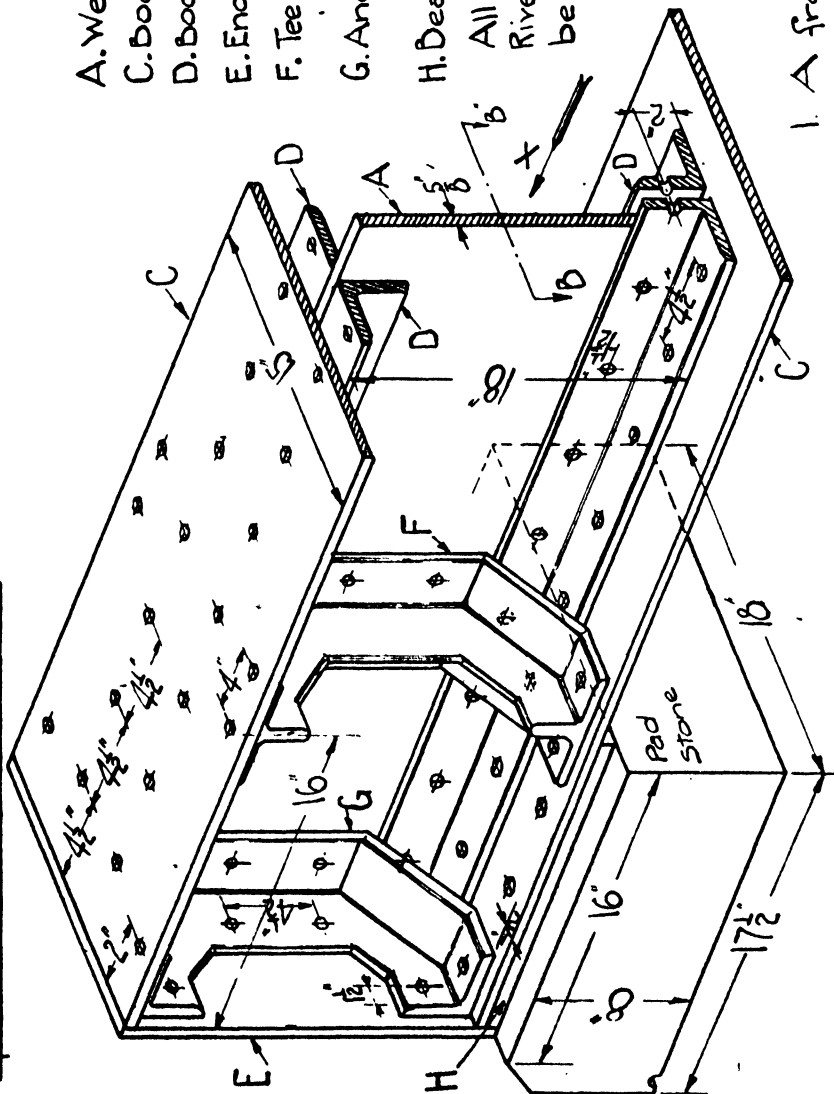
SHEET No 12 B



Draw 6" = 1 foot.

1. A front elevation
2. A sectional end elevation through A-B
3. A sectional plan through C-D.





### DATA

- A. Web plate  $\frac{5}{8}$ " thick
  - C. Boom plates  $\frac{3}{8}$ " thick
  - D. Boom angles  $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$
  - E. End plate  $\frac{1}{2}$ " thick
  - F. Tee stiffener  $6 \times 3 \times \frac{1}{2}$   
cranked to avoid angles.
  - G. Angle stiffener  $3\frac{1}{2} \times 3\frac{1}{2} \times \frac{1}{2}$   
cranked to avoid angles.
  - H. Bearing plate  $\frac{5}{8}$ " thick
- All rivets  $\frac{7}{8}$ " dia.  
Rivets to rest on stone pad to be csk on the underside.

Draw  $3' = 1 \text{ foot}$

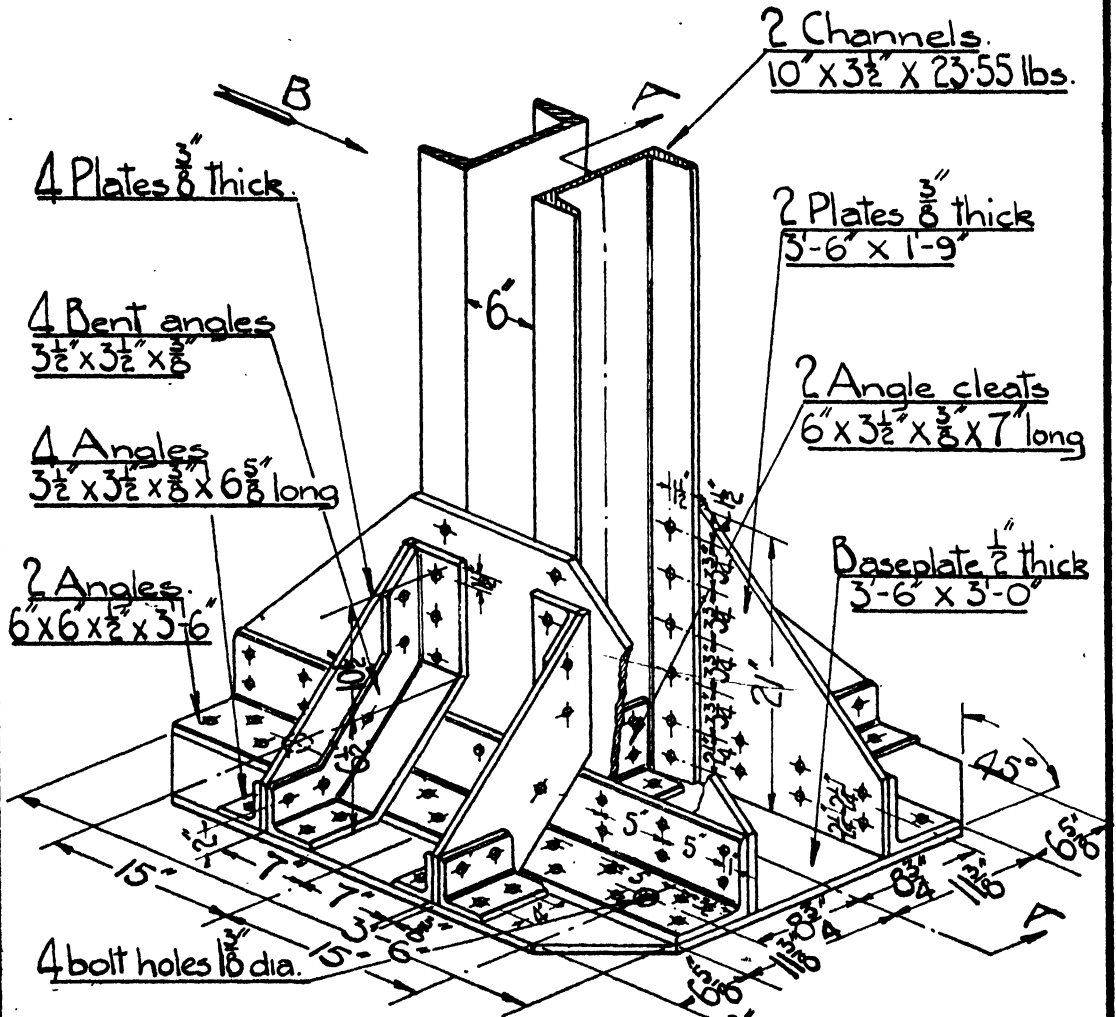
1. A front elevation

2. An end elevation looking  $\rightarrow$

3. A sectional plan through B-B.

STANCHION BASE. Mild steel.


SHEET NO. 15. B.



Draw to scale  $\frac{1}{2}'' = 1 \text{ foot}$ .

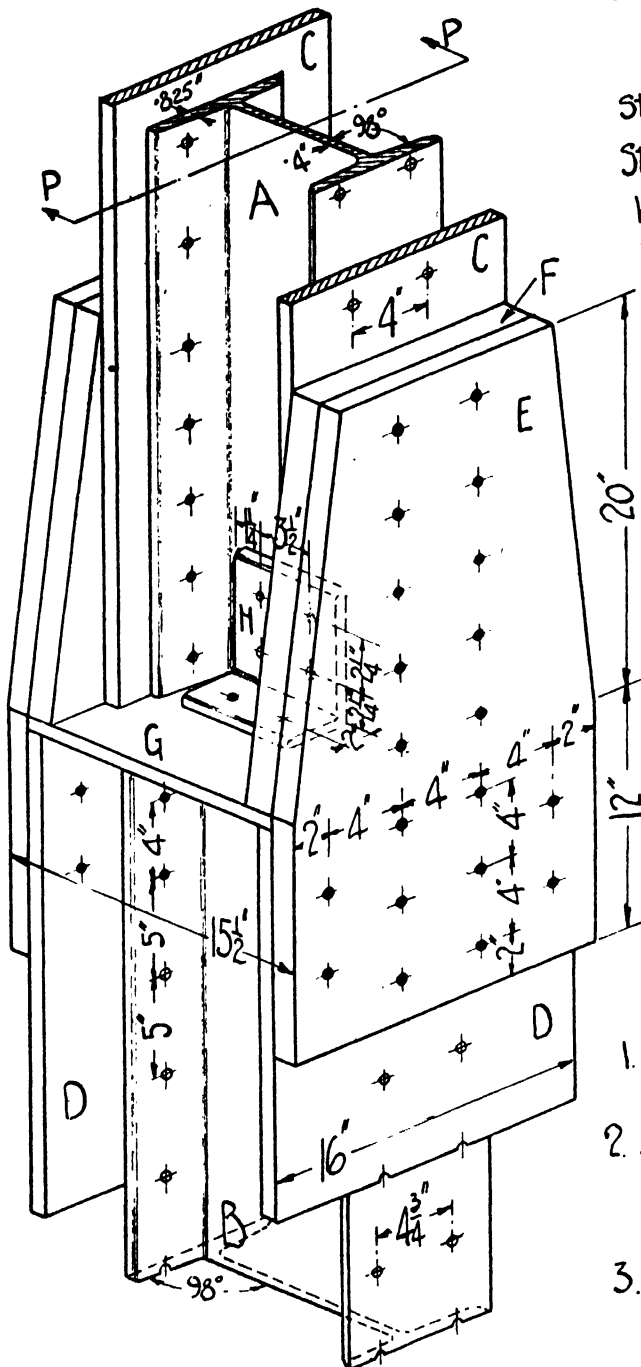
All rivets  $\frac{3}{4}$ " dia.

Rivets in baseplate to be c's'k.

1. A front elevation in half section through A-A
2. An end elevation looking 
3. A plan.

# STANCHION CONNECTION. Mild steel.

SHEET NO. 16B



## DATA

Stanchion A 9' x 7' x 50 lbs.

Stanchion B 12' x 8' x 65 lbs.

Web-plates C 12' x 3/4" thick.

Web plates D. 16' x 3/4" thick.

Connecting plates E 16' x 32' x 1" thick.

Packing plates F 16' x 20' x 1/2" thick.

End plate G. 13 1/2' x 16' x 3/4" thick.

4 Angle cleats H 6" x 3 1/2' x 3/8" x 6" long.

All bolts and rivets 3/4" dia

Bolts shown ●

Rivets shown. ○

Draw. 3" = 1 foot.

1. A front elevation
2. A sectional end elevation through P-P.
3. A plan.



# DIAPHRAM STIFFENERS for BOX GIRDER. Mild steel.

SHEET NO.17B.

## DATA

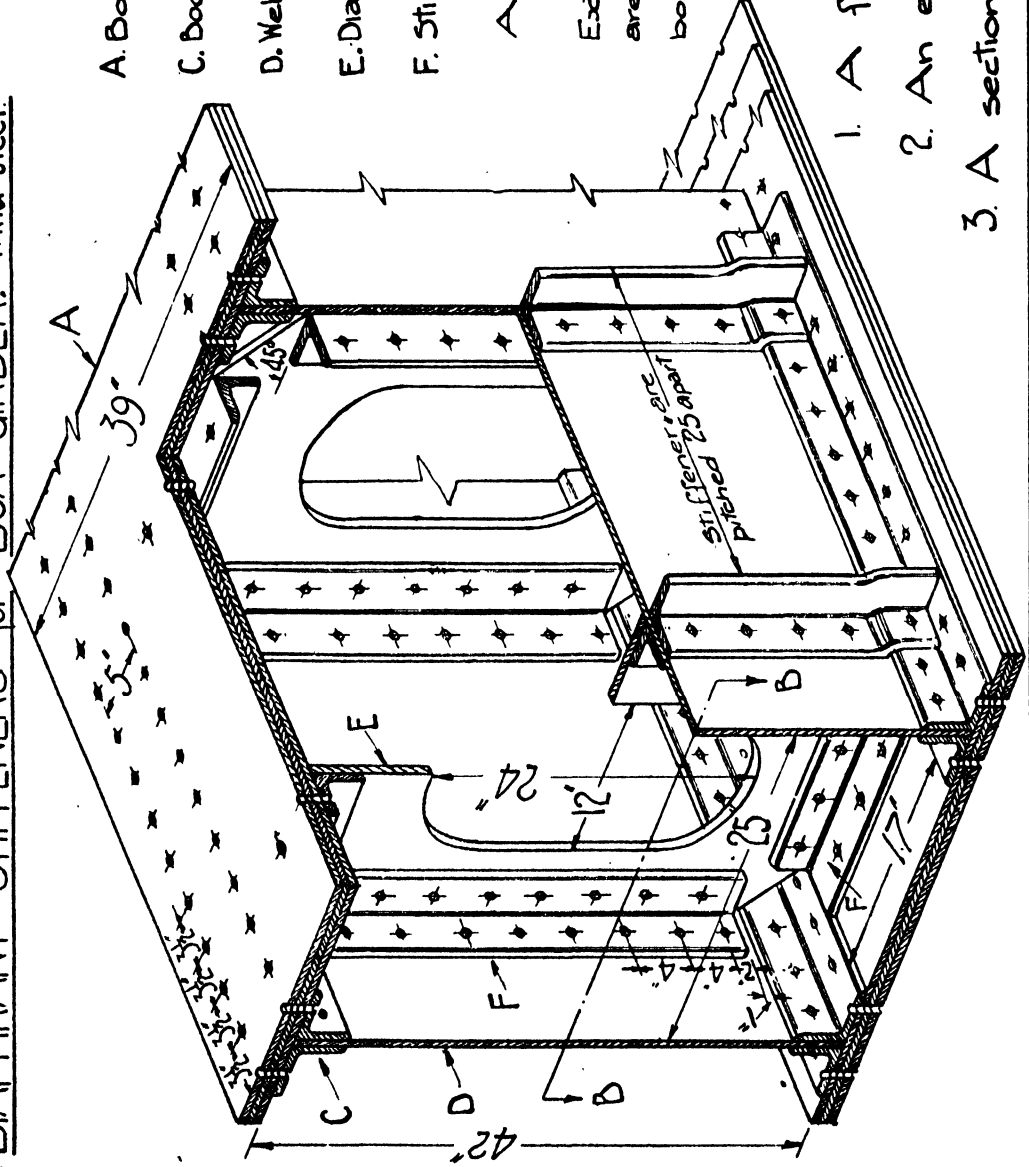
- A. Boom plates 39" wide X  $\frac{1}{2}$ " thick
- C. Boom angles 4" X 4" X  $\frac{1}{2}$ "
- D. Web plates 42" wide X  $\frac{1}{2}$ " thick
- E. Diaphragm plates 42" X 25" X  $\frac{1}{2}$ " thick
- F. Stiffener angles  $3\frac{1}{2}$ " X  $3\frac{1}{2}$ " X  $\frac{1}{2}$ "

All rivets  $\frac{7}{8}$ " dia.

External stiffener angles are joggled to avoid the boom angles.

Draw  $1\frac{1}{2}$ " = 1 foot.

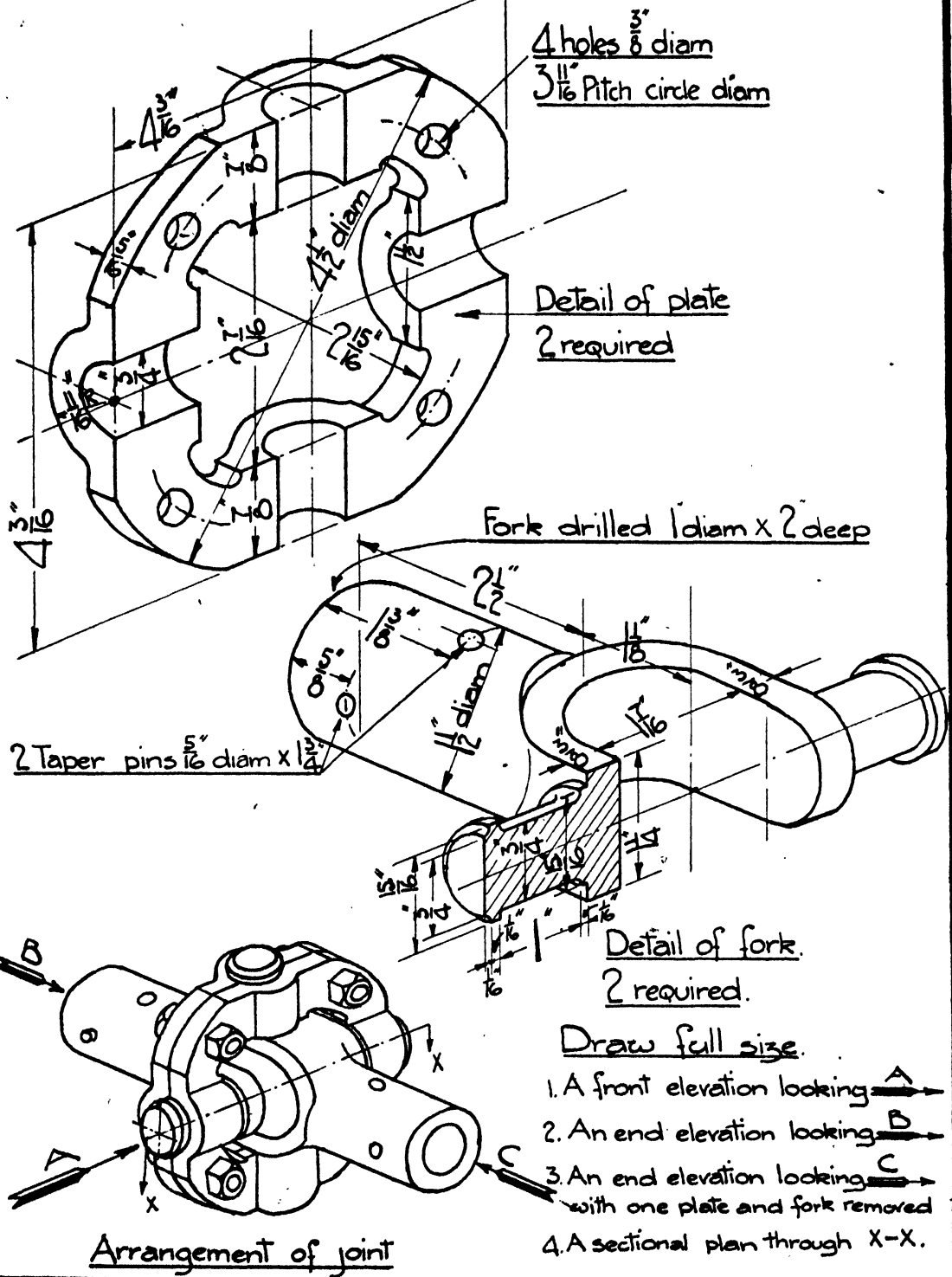
1. A front elevation.
2. An end elevation.
3. A sectional plan thro' B-B





# UNIVERSAL JOINT Mild steel

SHEET NO. 19B.



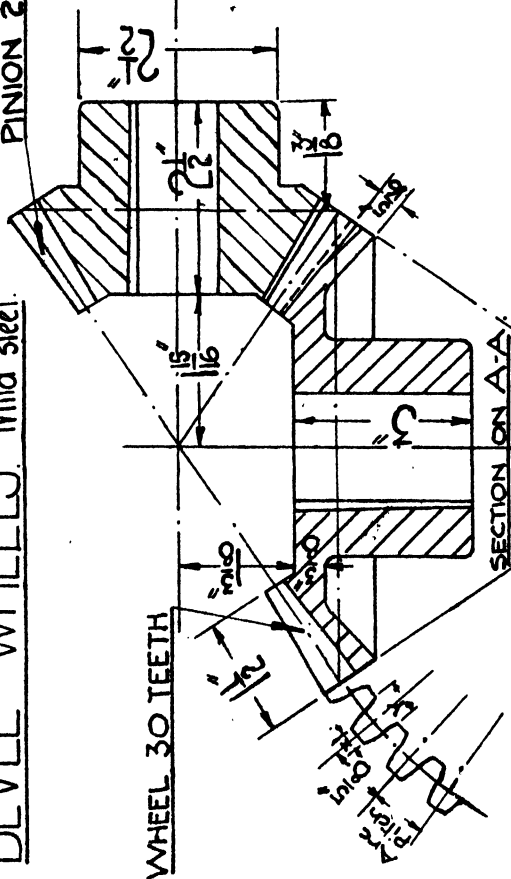
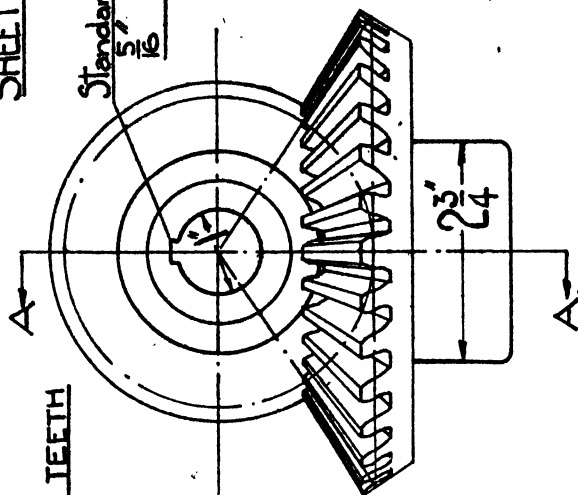


SHEET No. 21.B.

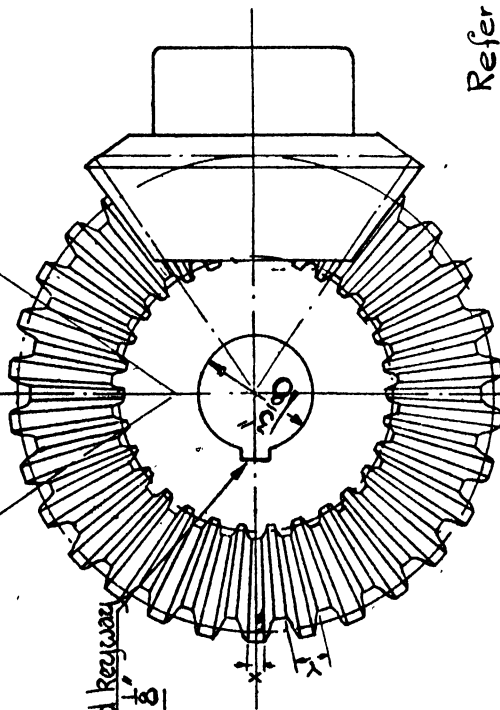
Mild steel.

PINION 20 TEETH

Standard keyway.



SECTION ON A-A



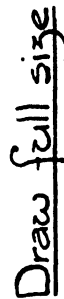
~~Standard Keyway~~


Draw full size.

1. A sectional front elevation
2. An end elevation with a blank pinion
3. A plan with a blank pinion

Refer to page 24 for proportions of teeth.

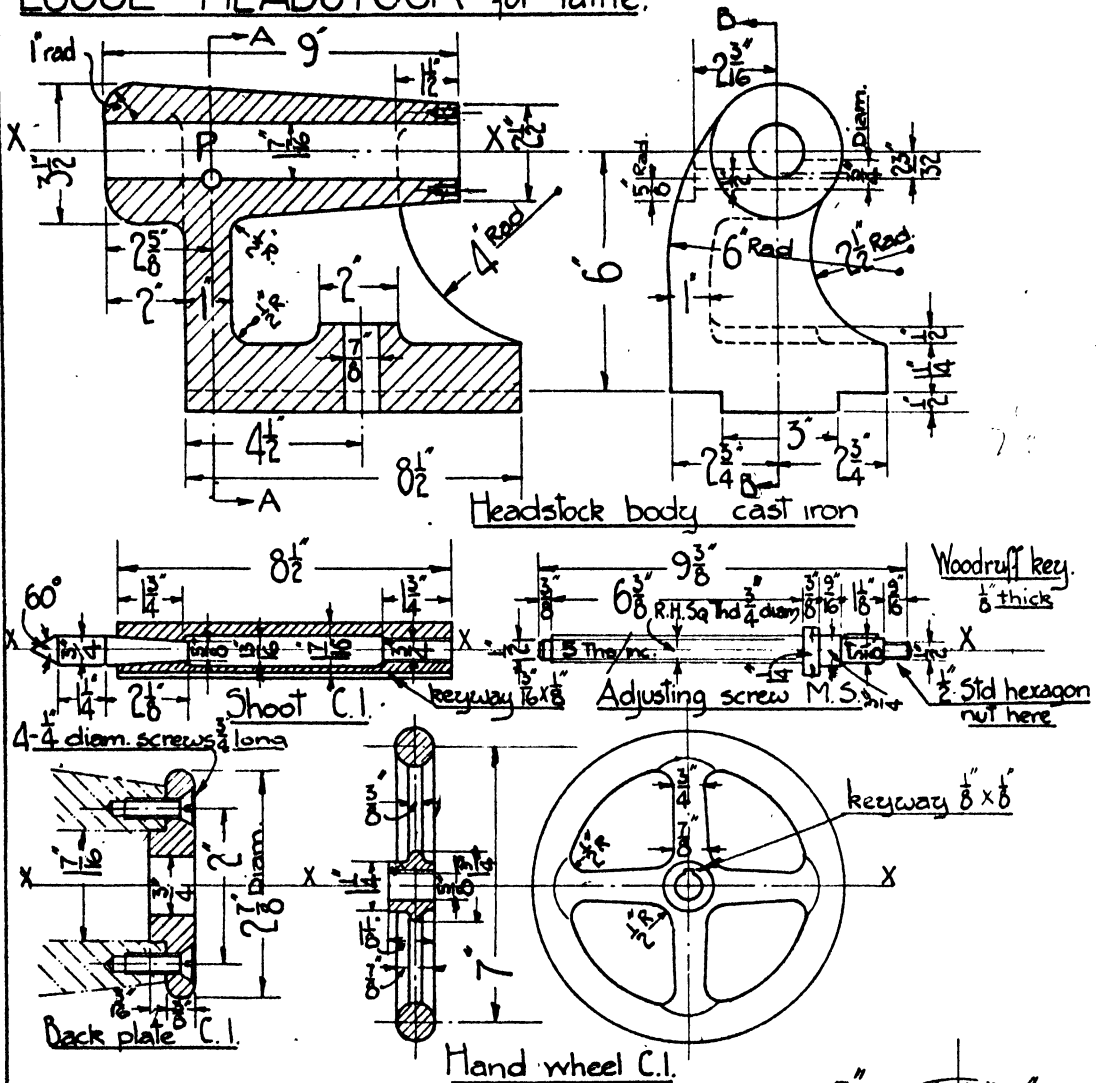
SHEET NO. 22B.



1. A sectional front elevation
2. An end elevation looking  A.
3. A plan.

# LOOSE HEADSTOCK for lathe.

SHEET NO.23B.



Draw to scale of 9" = 1 foot.

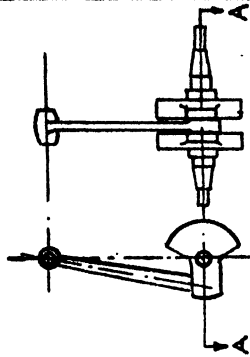
with all the parts assembled.

Note:- X is the common centre line.

1. A sectional front elevation through B-B.
2. A sectional end elevation through A-A
3. A plan without handwheel.

# BALANCED CRANK for Motor Cycle.

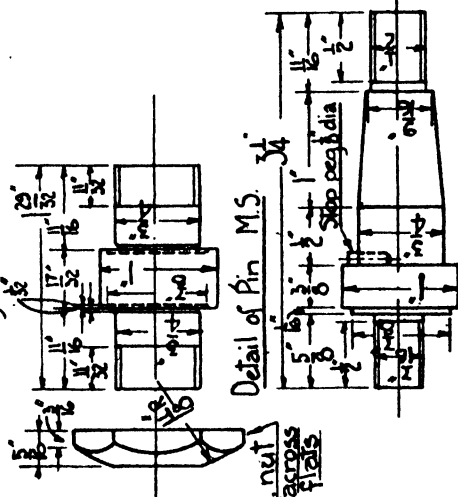
SHEET No 24 B.



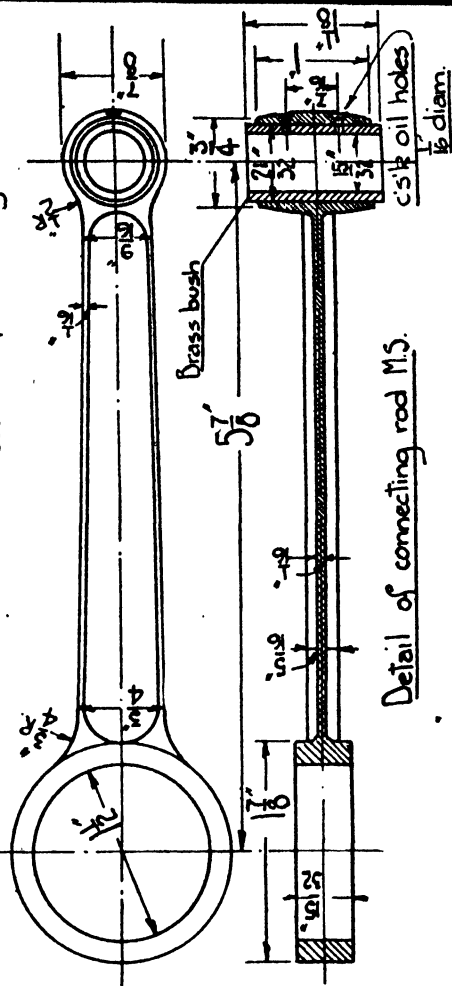
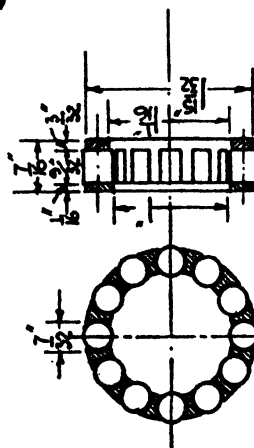
### Arrangement of details assembled.

Draw full size.

1. A front elevation
2. An end elevation
3. A sectional plan through A-A.



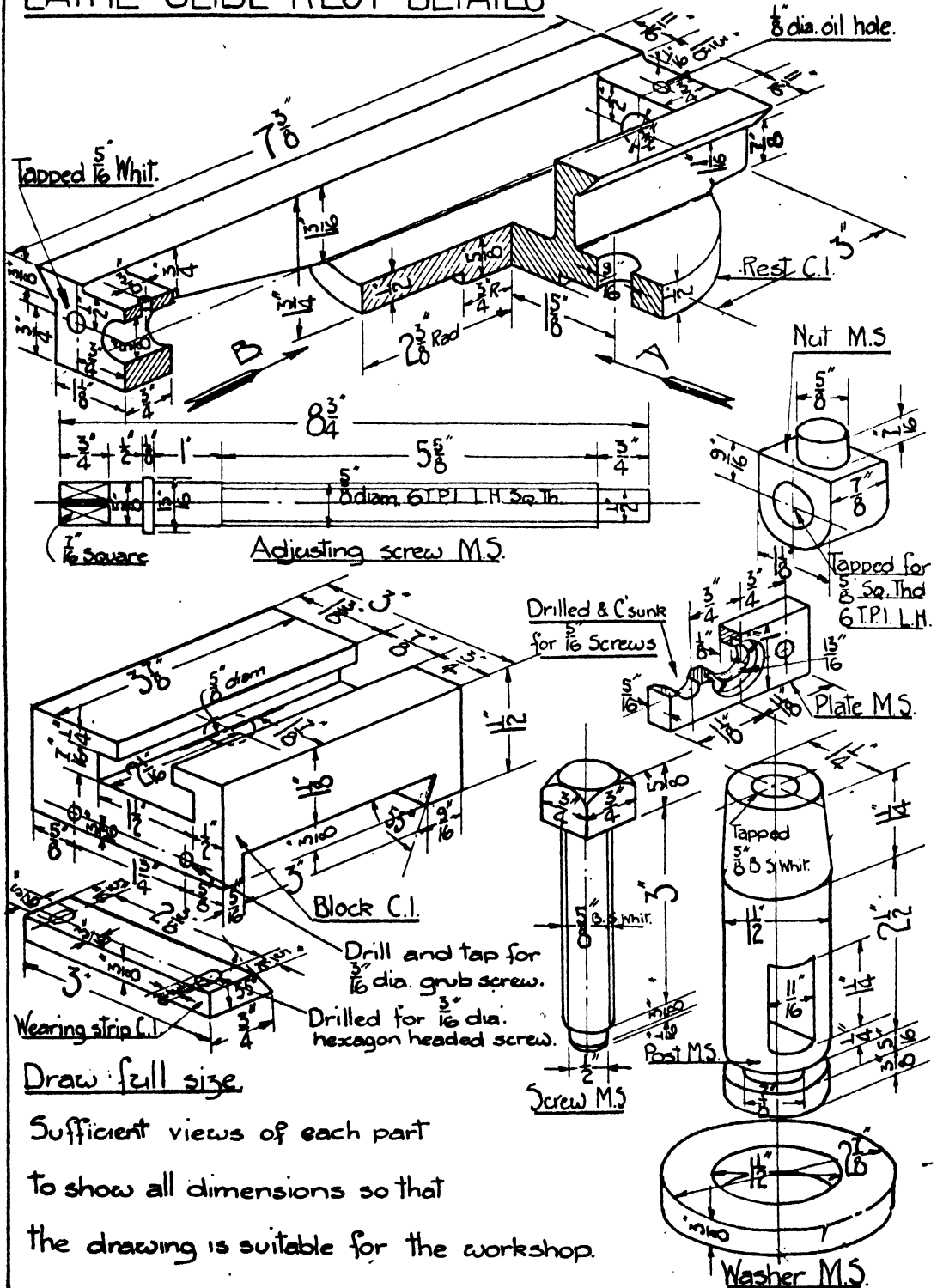
Detail of shaft. M.S.  
12 required





# LATHE SLIDE REST DETAILS

SHEET NO. 25 B



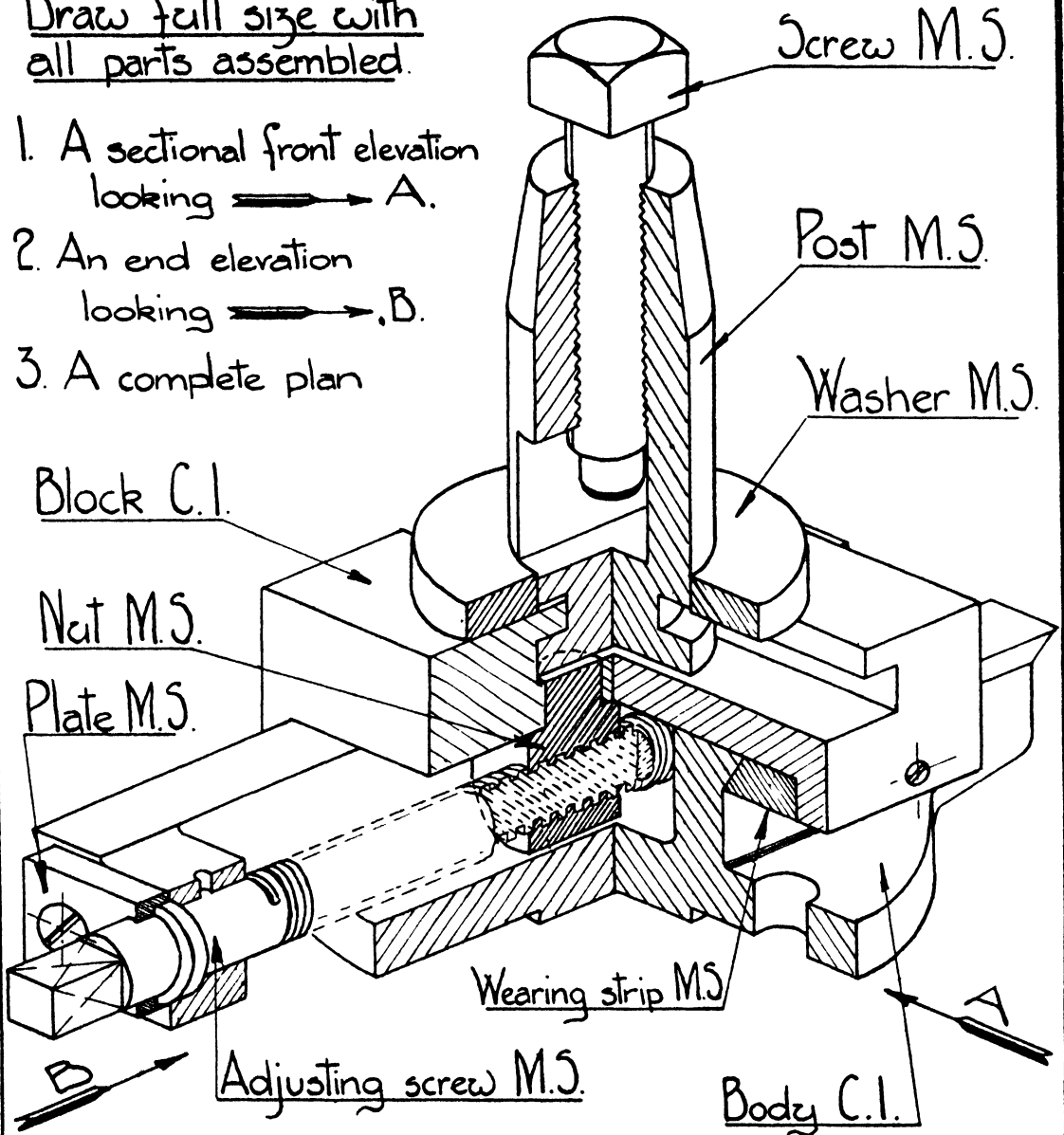
# LATHE SLIDE REST.

SHEET NO. 26.B.

Arrangement shown in quarter section.

Draw full size with  
all parts assembled.

1. A sectional front elevation  
looking  $\Rightarrow$  A.
2. An end elevation  
looking  $\Rightarrow$  B.
3. A complete plan



All dimensions are given on detail sheet NO. 25.B.



